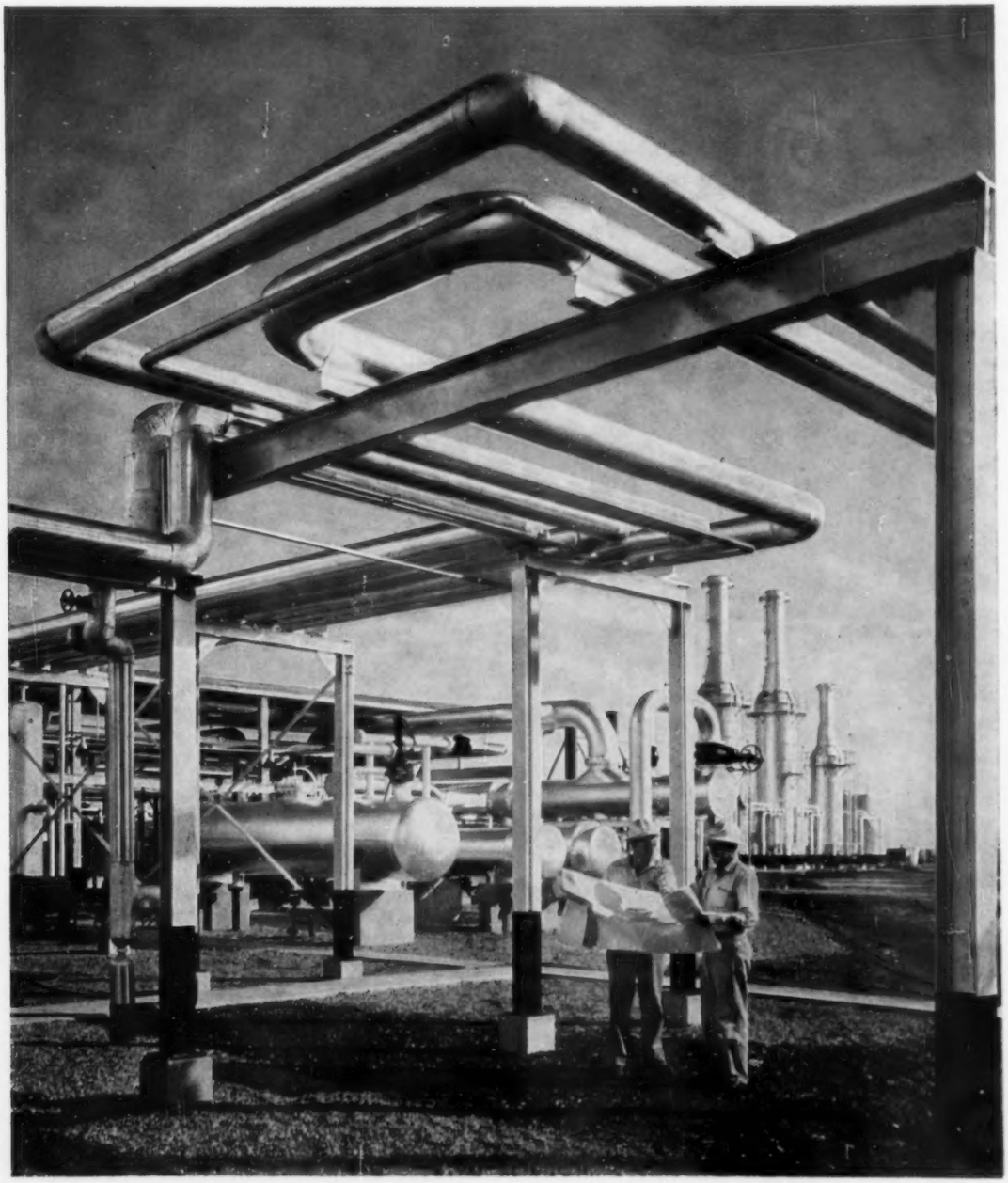
WORLD PETROLEUM

JUNE 1958



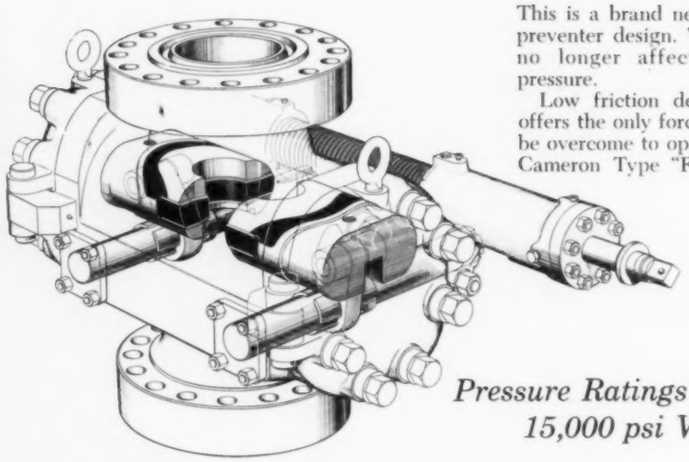
Special feature: Text of new 75—25 concession in Iran . . . page 92

ten dollars per year one dollar per copy

table of contents page 3

Cameron TYPE "F" BLOWOUT PREVENTER

"The Preventer with Pressure Balanced Design"



This is a brand new concept in preventer design. Well pressure no longer affects operating pressure.

Low friction design packing offers the only force which must be overcome to operate the new Cameron Type "F."

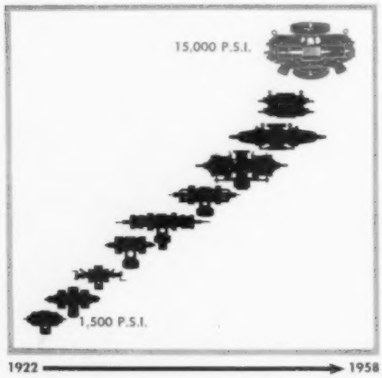
Pressure Ratings through 15,000 psi W.P.

WELLS GO DEEPER
PRESSURES GO HIGHER

But Research Never Stops

New, high range test facilities had to be built for the Type "F" Preventer research and development. Pressure extremes and flow rates not yet encountered in the field are produced under test conditions.

Directions for design improvement and the soundness of new theories are quickly revealed, making this work one of our most important activities. But fact-finding is, of course, only part of the job. Every phase of design development must be coordinated with manufacturing. Designs must be practical in the shop as well as in the field. Here again our facilities are unique. Cameron manufacturing processes are the most advanced in the industry. For instance, we make our own high quality alloy steel. We forge it on huge presses built to our own specifications. Finally, we machine, assemble and test this equipment with all the careful attention a product deserves when it is the finest of its kind.



The need for reliable blowout preventers became critical in the early 1920's. Drilling depths had at that time reached gas pressure zones which were increasingly difficult to hold. Available equipment dramatically failed in the field and losses ran high. The first successful blowout preventer, a Cameron design developed during this period, solved the problem and met with instant success. Every Cameron preventer since has anticipated the need for adequate protection and has been ready when higher pressures were encountered. As wells go deeper, pressures increase and equipment to control these pressures becomes a necessity. The Cameron Type "F" Preventer is the latest design in an evolution which has met every new drilling pressure control demand over the years.

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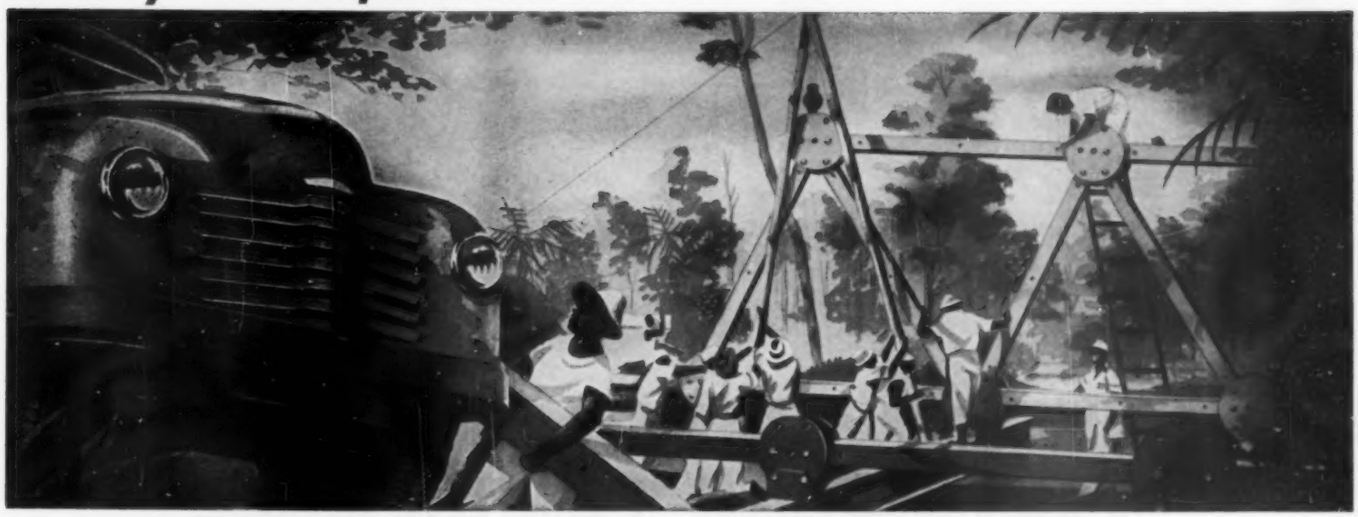

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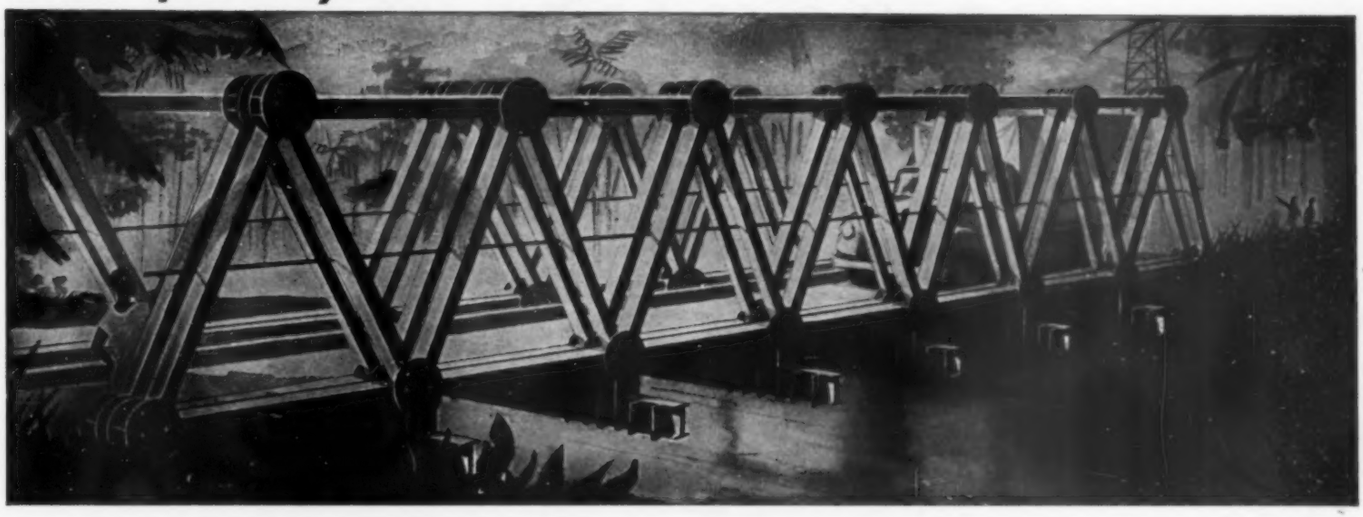

remote up-country sites

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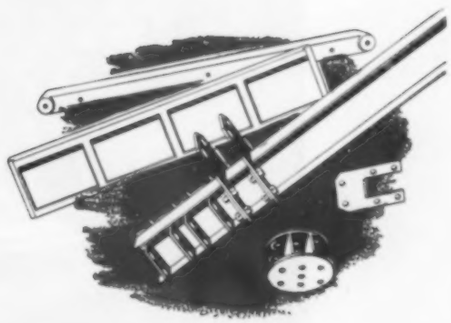

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385 Madison Avenue New York 17, N. Y.

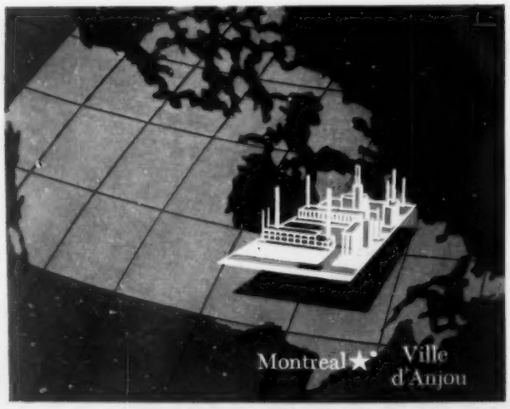
LUMMUS COMPANY CANADA LIMITED TO ENGINEER AND CONSTRUCT 25,000 B/D COMPLETE REFINERY

New Installation for BP Canada Limited Planned for Completion by the Middle of 1960

The Lummus Company Canada Limited has been announced as the successful contractor by BP Canada Limited to engineer and construct the new 25,000 B/D BP refinery at Ville d'Anjou, near Montreal, P. Q., Canada.

The basic process units will consist of a crude distillation unit with a total charge of 25,000 BSD, a distillate treatment unit with a charge of 12,000 BSD, a catalytic reforming unit with a charge of 6,000 BSD, and a catalytic cracking and polymerization unit with a fresh feed charge of 9,000 BSD.

In addition, the refinery will contain a wharf and transit site for the receipt of feedstocks and the dispatching of products by tankers, and a pipe route connecting the refinery to the wharf and transit site. There also will be road and rail distribution facilities for products, necessary tankage, utilities and buildings, and fire fighting facilities. The refinery will be laid out in such a way as to permit future expansion double that of the original capacity.



The refinery is being designed by The Lummus Company Canada Limited to produce primarily 400,000 tons per year of gasoline, and, in addition, aviation turbine fuel, stove oil, diesel oil, and other products. Preliminary work on the site and on a three mile pipeline to the St. Lawrence River is already under way.

BP Canada Limited, with its executive office in Montreal, is the subsidiary of British Petroleum Company Limited, conducting marketing operations in Canada. It is understood that another BP company is being formed to own and operate the refinery.

The refinery at Ville d'Anjou will be the twentieth complete refinery engineered by Lummus throughout the world since the end of World War II. For design, engineering and construction of refineries anywhere in the world—Lummus' over fifty years of world-wide experience on over 700 plants for the process industries is at your disposal.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N.Y., Houston, Chicago, Washington, D.C., Montreal, London, Paris, The Hague, Caracas, Maracaibo. *Engineering Development Center*, Newark, New Jersey.

WORLD PETROLEUM FOR JUNE, 1958, Vol. 29, No. 6, June, 1958. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, Emmett Street, Bristol, Conn. Editorial and Executive offices, 604 Fifth Avenue, New York 20, N. Y. Accepted as a controlled circulation publication at Bristol, Conn. Subscription rate: $10.00 per year. Single copies $1.00.

FOUNDED BY RUSSELL PALMER

Publisher MONA PALMER
Editor J. C. CHATFIELD
Managing Editor G. H. BARROWS
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Art Director CHARLOTTE BLASS

Member of National Business Publications, Inc., and Business Publications Audit of Circulation, Inc.

SUBSCRIPTIONS

1 year, $10.00 2 years, $18.00
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J. B. Huttlinger National Press Building
14th and F Streets (Tel. EX3-3733)

LOS ANGELES 14

T. T. Drake 412 West Sixth St. (Tel. MUtual 1391)

NEW YORK 20

Sales Representative
E. L. Townsend
604 Fifth Avenue (Tel. JUdson 6-4820)

TULSA 3

O. F. Cozier, Mid-Continent Advertising Manager, 605 Mayo Bld'g. (Tel. Diamond 3-1335)

World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer
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VOL. 29, NO. 6 JUNE, 1958

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

CONTENTS

4 Washington Pipeline, *by Joseph Huttlinger*

8 London Letter, *by A. L. Paget*

12 Latin American Oil News

14 Canadian Notes

30 Oil Company Staff Changes

37 Editorial—Danger Ahead

38 Brazil's Oil Potential—An Economic and Geologic Evaluation, *by Dr. John O. Nigra*

43 Oil Faces East

44 Finland's First Refinery, *by Carl H. Gamer*

48 Chemical and Petroleum Engineering Exhibition at Olympia, *by A. L. Paget*

50 Oil Company Earnings—Down in 1958

55 Petrochemical Growth in Europe, *by Vernell Skulan*

66 Review of USA Patents on Petrochemicals, *by Heinz Heinemann and Harold Shalit*

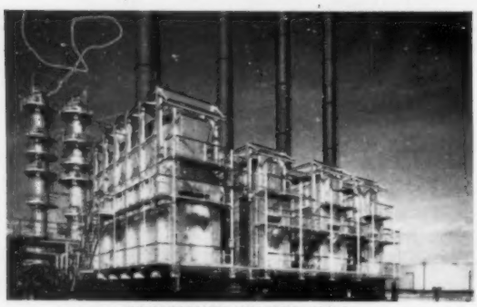
92 IPAC Concession Sets Trend in Iran

100 Advertisers' Index

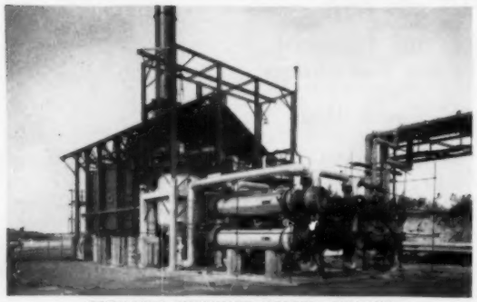
THIS MONTH'S COVER

Ohio Oil Company's gasoline plant in the North Markham, North Bay City, Texas, area. Overhead piping is metal sheathed and virtually all plant components painted aluminum except for the splash areas near the ground. Result is the gleaming silver-like unit pictured by Tony Linck's camera. Color plates are reproduced through the courtesy of Eugene L. Price, editor of *The Beacon*, Ohio Oil's house magazine.

CRUDE HEATERS, VENEZUELA



SOVAFORMER HEATERS, U.S.A.



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Whether for petroleum refineries, chemical or petrochemical plants, Lummus will design, engineer and construct your next heater installation—regardless of size or type—for any major process, around the world.

Lummus heater services are made available on three bases: 1. engineering only; 2. with all material delivered to job site; and 3. completely erected.

Lummus horizontal tube or vertical tube oil heaters, of both special and standard design, range from 100,000 to 300,000,000 Btu per hour. In the last 25 years, the combined capacity of Lummus oil heaters purchased has exceeded that of any other company in the world.

As illustrated above, neither size nor location of the unit presents a problem to Lummus. These units are designed and engineered by the Lummus New York staff, who put the full benefit of their accumulated years of experience into each job. Procurement is made through the nearest of the five Lummus international group of companies and the cost of the job is payable in the currency of the country in which the procurement is handled!

Consult with Lummus on your next oil heater.

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CHICAGO, WASHINGTON, D. C., HOUSTON, MONTREAL, CARACAS, MARACAIBO, LONDON, PARIS, THE HAGUE

Washington

By Joseph B. Huttlinger

Defense Reverses Its Policy

In a historic letter, Department of Defense now says it would be "folly" for the USA to rely on foreign oil in peace or war. The letter, which marks a change in top-level oil policy, said:

"Recent developments in the Middle East vividly demonstrate the folly of depending on foreign oil to supplement local supplies, even in peacetime. It would obviously be extremely dangerous to rely on foreign sources of supply in time of war."

The letter—cleared with top Defense Department officials and the Eisenhower administration through the Bureau of the Budget—indicates top policy is aimed more than ever at encouraging USA oil supply. In the past, Defense officials have emphasized the need for foreign-oil supply to supplement USA supplies, to preserve the economy of friendly countries and to have a source of supply for troops and bases abroad in time of emergency.

The letter put the Department of Defense "fully in accord" with pending legislation to boost the income-tax depletion rate on oil from shale to 27.5% from 15%. The letter estimated USA shale-oil reserves at 50 times the USA crude-oil reserves. The letter virtually invited those interested in steps to help oil shale become a going industry to seek additional government help; for it expressed "misgivings" as to whether the depletion aid would be "sufficient."

Rear Admiral E. C. Stephan of the Navy, chief of legislative liaison, signed the letter.

The State Department, meanwhile, refusing to take a stand on the tax-aid proposal, said shale oil constitutes "our ultimate national petroleum reserve." Representative Wayne Aspinall (D., Colo.) is leader in the fight for the higher depletion rate for shale. Secretary of Interior Seaton favors the shale-oil tax aid.

No Clearcut Gas Rules Yet

Federal Power Commission, which has been regulating the price of natural gas sold by oil and gas producers for four years, has yet to set forth clearcut standards. Oil and gas interests are not pushing the matter. They fear this would persuade FPC to go to one measure which is easiest of all—cost of producing gas. This not only would put gas producers under the sharpest federal controls, but also reach out to crude oil, for oil is found the same way as gas—often in the same well, and by the same company.

Pipeline

To Appeal Pipeline Cases

Department of Justice has several oil pipeline matters under study, amid prospects something will come out of it before long. First news may come on or before May 26 deadline for the DJ to appeal in the three oil pipeline cases brought under 1941 Elkins act consent decree. Any appeal would be to US Court of Appeals, not the US Supreme Court.

DJ lost so thoroughly before US District Judge Richmond B. Keech, of Washington, D.C. in March that it may drop the appeal, or start a new case.

The three cases, charging oil pipelines with paying their shipper-owners larger dividends than the 7% allowed by the consent decree, are vitally important to oil and gas. They were against Arapahoe Pipe Line Co., and Service Pipe Line Co. More than a dozen other companies entered the case as parties of interest.

Judge Keech said the consent decree is clear upon its face; even if it were not, he added, DJ had waited too long to act. DJ is considering an appeal to the high court. Also, officials are considering a new case, under which the consent decree, itself, would be attacked as illegal.

Hughes Consent Decree

Department of Justice, which recently reached a consent settlement of an antitrust action against the Hughes Tool Co., Houston, turns out to be more sensitive than many had thought. Announcing settlement, DJ said Hughes had agreed to end certain "restrictive" practices in sale and distribution of oil and gas well drilling equipment. Alfred Wirth & Co., of Germany, was named in the case. At the same time, Maynard E. Montrose, vice president for sales of Hughes, put out a statement explaining Hughes settled because the "costs" of defending the antitrust action would have been too large.

Victor E. Hansen, assistant attorney general for antitrust, then issued copies of a letter he had written to Howard R. Hughes, president, asking "disavowal" of the "costs" statement, or that Hughes join in asking the courts for "speedy, inexpensive litigation" of the matter. Hughes withheld public comment—thus, apparently, ending the matter.

Offshore Defense Purchases

Department of Defense, which buys about one-fourth of its oil products outside USA, plans to continue—as the way to obtain "the lowest delivered cost," and to maintain "a mobilization base in friendly foreign areas." Also, there are areas where a foreign refinery is the "only practical means" of supply for the products.

Defense officials gave these facts during appropriation hearings, as Congressmen warned some USA oil producers were "complaining." During the fiscal year ending next June 30, it was explained, Defense will buy $1,100 million worth of products, $258 million of it offshore.

Grill Floors
Low weight and high strength combined with non-slip cleanliness are features which make these the perfect flooring for process plants, towers, factories, etc.
This Gas bleeder tower for the Steel Company of Wales, Kenfig, is another example of the versatility of Grill Flooring. Contractors: Messrs. Rees & Kirby.
Grill Flooring fitted at Stanlow Refinery, Ellesmere Port, Cheshire. (Shell Refinery Co. Ltd.)
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Grams: ETYLADEC WESPHONE LONDON

Have You Ever Read The Small Print To Really See

What's In A Guarantee?

Let's Examine An Average Guarantee

Most guarantees sound about alike. Although the wording may be slightly different, they usually have about the same meaning and give the same protection.

The average warranty or guarantee is fine, as far as it goes. But how much protection does it really give the buyer? Let's analyze the "fine print" in an average factory warranty and see!

First, the average warranty or guarantee simply sets forth that the equipment is guaranteed in event of defective materials or workmanship. The warranty is not a guarantee to the buyer that the equipment he has bought will do **his** job.

Second, the average warranty is for a specific period of time. What happens to the equipment after that period is the sole responsibility of the owner.

Third, the average warranty . . . in case of a failure that does come within the limits of the guarantee . . . does not cover normal wear in the period the equipment was used, or the cost of installing new equipment.

So, after you boil it all down, the average warranty is chiefly a protection to the manufacturer and carefully limits in detail his responsibilities to the buyer only to the extent of defective materials or workmanship for a specific time.

In the final analysis, the average warranty does not fully protect the buyer. It is primarily a protection to the manufacturer.

Now, Let's Examine A Stewart & Stevenson Guarantee

When you buy an engine or any other product from Stewart & Stevenson Services, you are protected by **two** guarantees . . . the factory warranty against defective workmanship or materials **and** the unquestionable Stewart & Stevenson "guarantee of duty."

There is no fine print in the Stewart & Stevenson guarantee.

We have made it as simple and straightforward as we know how. And here's what it means to the buyer. It means that Stewart & Stevenson Services guarantees your engine or equipment to do the job you bought it to do on your specific application—not just develop a certain amount of horsepower. That's important!

The Stewart & Stevenson guarantee of duty specifies in plain and simple language what your engine is supposed to do on your particular job—to *your* specifications—and this Stewart & Stevenson guarantee is backed up with a provision that if your engine or equipment should fail and we cannot make it perform as specified when you bought it, we will remove the engine at our expense and refund *all* money paid.

Now, in plain language, what does a Stewart & Stevenson guarantee really mean to the buyer? It means this: when you deal with Stewart & Stevenson Services, you have the protection of a guaranteed service policy—plus the manufacturer's warranty—and you know that there is no way in the world for you to buy equipment that won't do your job in the manner you intended.

For more than fifty-five years, Stewart & Stevenson has been practicing this policy . . . a policy of a full measure guarantee and square dealing that has resulted in Stewart & Stevenson Services becoming the largest distributor of General Motors Diesel Engines in the world.

So, when you get ready to deal on power requirements, talk to your Stewart & Stevenson representative. We will plan and engineer your power needs in the shortest possible time and give you a guarantee that will "hold water," and assure that the equipment will do the job you buy it to do!

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Iso-Kel (8pp). Details of a new isomerization process which gives greater flexibility and economy in making all grades of gasoline.

B

Kwinana Refinery (16pp). Details of the huge BP plant in Australia; its numerous offsite facilities; and how work was coordinated.

C

Continuous Analysis (8pp). An instrument engineer reports on analyzers as a key to improved processing. Types of analyzers are described.

D

Automation (16pp). An easy-to-grasp treatise of a complex subject. Graphically explains automation and the instruments that make it work.

E

Hydrogen Sulfide Corrosion (22pp). A compilation of technical information on sulfide corrosion at high temperatures and pressures in the petroleum industry.

F

The 450 Ton Lift (8pp). A dramatic account, with photos taken on the spot, of the lifting and positioning of a Texas Tower. Diagrams show how it was engineered.

G

Daura Refinery (12pp). A description of Iraq's Baghdad project, printed in Arabic, English, and Hindi. Emphasis is given to utilities problems.

H

New Instruments for High Pressure (8pp). A report from a leading instrument engineer as to how tomorrow's processes above 10,000 psi will be measured.

I

Concon Refinery (8pp). Printed in Portuguese, Spanish, English, this account of Chile's first major refinery highlights design features and economics.

J

The Giant Step (20pp). From Kellogg's Defense Products Division, a guide for engineers facing technological problems in developing or producing defense material.

K

Yorktown Refinery (16pp). A record of cooperation in engineering and building a 35,000 BPD refinery for Amoco, including effluent treating facilities.

L

Calculation of Liquid-Vapor Equilibrium Constants from Solubility Data (8pp). One of many technical papers written for the chemical press by Kellogg engineers.

M

Gasoline from Coal (12pp). This report on the world's largest commercial plant of its type gives details of process, yields, other pertinent facts.

N

Models (12pp). A comprehensive description of the time-and-money-saving technique of using scale models as design tools. Many examples are illustrated.

O

Solvent Decarbonizing (16pp). A highly documented review of this flexible process for producing high octane and meeting varying market needs.

YOURS FOR THE ASKING!

Among these 15 booklets and folders are many that Kellogg believes would be helpful to oil refiners and others. Largely a record of some of the company's engineering and construction work over the past few years, they cover a diversity of technological and economic problems and how they were solved.

Kellogg's Contract Sales Division welcomes the opportunity to share this valuable experience with others by sending, without charge, copies of any or all of the items listed to interested petroleum refiners or chemical companies. Requests will be filled in the order received, since the supply is limited. There is no obligation, but use of the coupon would be appreciated in order to facilitate handling.

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WPG. 258

LONDON LETTER

By A. L. Paget

Surplus Tankers

A plan to use surplus tankers for storing oil is being discussed between shipping interests in London and the British government. There are now some 4¼ million tons of tankers laid up, and it is believed some of these could be put back into service as part of a government-backed plan to protect British and European industry from another disturbance of the Suez type as a result of events in the Middle East. Some of the tankers still in commission are taking the long route around the cape, instead of the short one through the Suez Canal. They do this because their owners can find no alternative employment for them when the voyage is over and prefer to have them dawdling at sea rather than face the expense of laying them up or keeping them idle in port.

Robust optimism is to be found in the annual report of the P. & O. Steam Navigation Co. Capital commitments for building new ships have risen over the year to £89 million from £39 million. Asked why the company should be building ships when the harbors of the world were becoming cluttered up with laid-up tonnage, the chairman, Sir William Currie, replied: "The decision to maintain the fleets must be founded on long-term considerations, and we continue to base our policy on the belief that our shipping services will continue to be needed and that the group should continue to apply its accumulated experience and resources to these activities." This vast program, which includes building of 18 tankers, will be spread up to 1963.

The tanker, "Clyde Crusader," recently arrived at Queen's Docks, Swansea, with the first cargo of crude oil to be exported from Nigeria to the United Kingdom.

Tanker News

The "New Mexico" a 28,000 dwt oil tanker building for The Texas Co. was launched, March 20, by Harland & Wolff Ltd. from their Belfast shipyard.

Propelling machinery of the "New Mexico" consists of a single-shaft arrangement of compound double-reduction geared turbines capable of developing 12,500 shp at a propeller speed of 100 rpm.

The single-screw 18,000 dwt steam tanker "Halia," constructed by Hawthorn Leslie (Shipbuilders) Ltd. for the Shell tanker fleet, has completed her trials off the River Tyne and delivered. The vessel's cargo space is divided into 11 main oil tanks, subdivided by two longitudinal bulkheads making 33 separate cargo tanks.

The launching of the "Denby Grange," a single-screw 18,000 dwt turbine tanker, was announced by Hawthorn Leslie for April 2.

Harland & Wolff Ltd. launched at Belfast the 19,700 dwt oil tanker "Vestfonn," building for Interessentkapet Vestfonn (Sigval Bergesen) of Stavanger, Norway. The "Vestfonn" is a single-screw motor-driven oil tanker.

The motorship "Moero," built by Chantiers Cockerill-Cugree for the Belgian Maritime Co., was launched, March 19, at Hoboken. This vessel is the third of a series of 11 under construction or on order.

London-Yorkshire Motorway

Harold Watkinson, Minister of Transport and Civil Aviation, has formally inaugurated construction of the London-Yorkshire motorway—to begin immediately. The first section, from London to Birmingham, which is 53 miles long and will cost £15 million, is to be completed in the record time of 19 months. Shell-Mex and BP Ltd. will supply fuels for sections A, B, and D; while section C will be supplied by the Mobil Oil Co. Ltd., which will also provide lubricants for all four sections. Many of the trucks, excavators, and earth-moving equipment will be working continuously day and night; therefore, Mobil is arranging to make delivery directly to the equipment from specially equipped delivery vehicles. Shell-Mex and BP will be using a modern depot at Northampton as the parent supply point, and have established fuel storage and dispensing sites in each of the sectors for which they are responsible.

At berthing ceremonies of BP "Clyde Crusader" at Llandarcy refinery with 7,000 tons of Nigerian crude, Mr. MBU, high commissioner for Nigeria, starts unloading. At left is C. Spark, tanker's captain. Right is A. E. C. Drake, a director of BP Trading Ltd. Watching unloading of first Nigerian crude to arrive in UK are Chief M. S. Sowele, commissioner for western Nigeria; and Mallam Abba Giddum Gana, acting commissioner for northern Nigeria.

Cranes For Iranian Fields

Six special fast-travel cranes, each one fitted with two Leyland direct-injection diesel engines, are now undergoing final tests prior to shipment to Iran for duty in the Iranian oil fields. The cranes, built by Thomas Smith & Sons (Rodley) Ltd., are mounted on six-wheel chassis built by All Wheel Drive Ltd., of Camberley. The two rear driving axles are fitted in the form of a bogie. They are fully-floating with overhead worm drives, and are coupled together by a short universally jointed propeller shaft. The axles have a high degree of articulation necessary for traversing rough country in safety.

Orders for diesel four- and six-wheeled trucks recently received by Leyland Motors from Iran total more than £350,000—approximately $1 million.

Visits Offshore Drilling Site

Following his recent visit to Canada to view the site for the new BP refinery at Montreal, Sir Neville Gass, chairman of the British Petroleum Co., has been touring BP interests in the Middle East. During his visit to the Persian Gulf, Sir Neville was received by the ruler of Abu Dhabi, and traveled by helicopter to the offshore drilling platform "Adma Enterprise," which is operating some 20 miles off Das Island.

Personals

On February 28, 1958, Sir James Swinburne, FRS —until 1948 chairman of Bakelite Ltd., and now company's honorary president—celebrated his hundredth birthday. A distinguished engineer, and one of the world's pioneers in the field of synthetic resins, he has had many interests during his long life. He is a past president of the Institution of Electrical Engineers and of the Faraday Socy., and a member of the Institution of Civil Engineers. He has published books on such diverse subjects as sociology and horology. Sir James has now retired from his many activities, to Bournemouth.

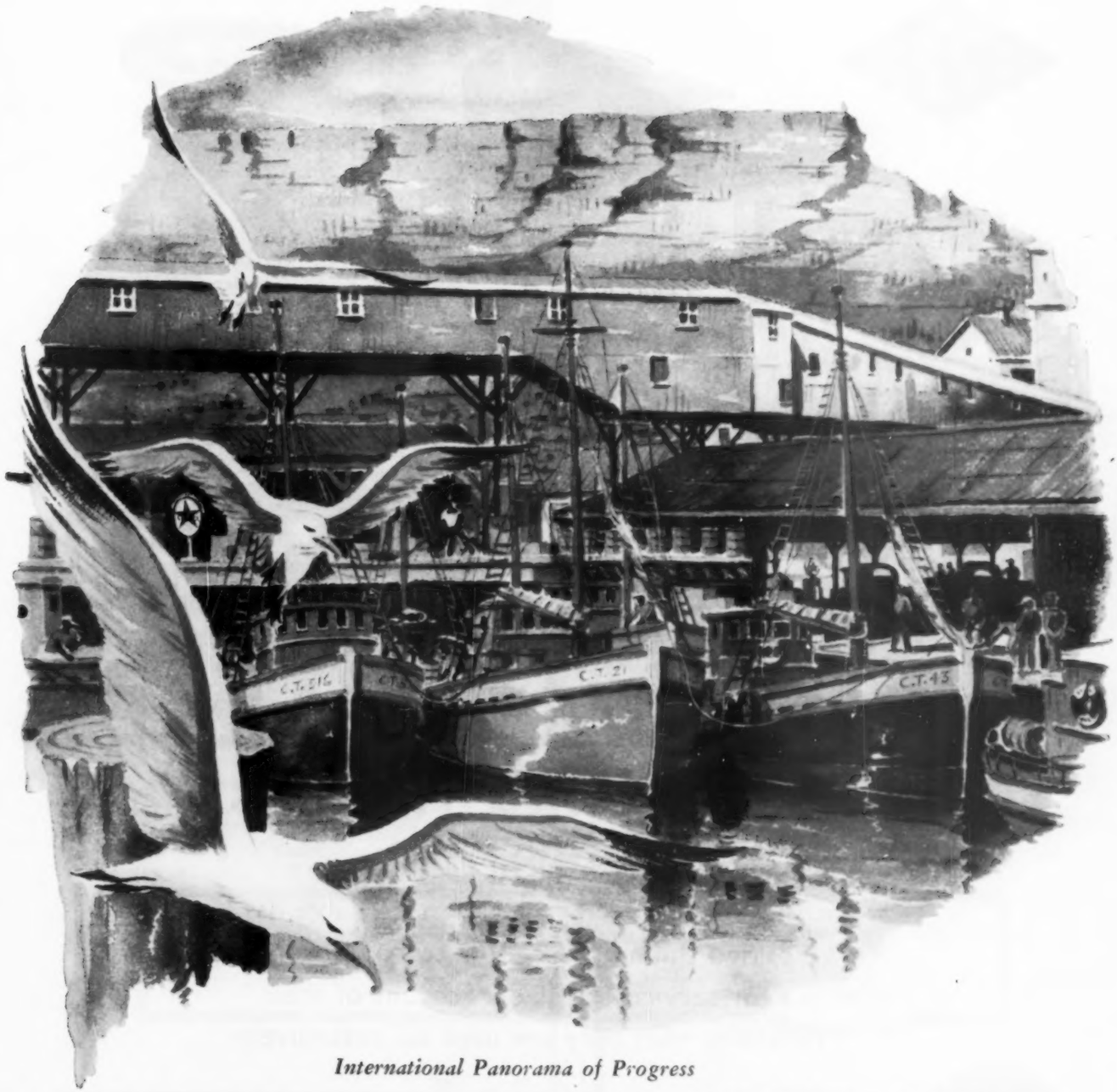
Captain W. M. Hutchison, CBE, chief superintendent of British Petroleum Tanker Co. Ltd., retired at the end of February 1958, after nearly 39 years' service with the company. After an early apprenticeship with H. Hogarth & Sons, he joined British Tanker Co. (as it was then called) in 1919, and was first appointed master in April 1928. He was transferred to shore duties in 1936, and promoted to chief marine superintendent in 1943. Captain Hutchison become a Commander of the Order of the British Empire in 1956. He is a fellow of the Royal Geographical Socy., the Royal Socy. of Arts, and a Warden of the Honorable Company of Master Mariners. He was elected a Freeman of the City of London in 1951.

Captain J. W. Ross, who succeeds him, becomes the first company ex-apprentice to hold this senior post. He joined the original British Tanker Co. in 1921, and was appointed to his first command in 1938. He was transferred to shore duties in 1942, established as a marine superintendent in 1943, and appointed deputy to Captain Hutchison in 1952.

W. F. Wackrill, OBE, a director of Esso Petroleum Co. Ltd., retired, February 28, under the company's retirement plan. He joined Esso Transportation Co. in 1946 as general manager; appointed a director the following year, and managing director in 1952. When the marine activities of the Esso group were reorganized in 1954, he was made a director of Esso Petroleum Co. Ltd. Mr. Wackrill was formerly in the civil service—becoming assistant secretary, Ministry of Shipping and War Transport, during the war, and director of the Ministry's Tanker Division in 1945-46. Until recently he was a member of the Council of the Chamber of Shipping, of the Executive Council of the Shipping Federation, and of the Committee of *Lloyd's Register of Shipping*.

Third 34,000-Ton Tanker for BP

The third 34,000 dwt tanker to be launched for BP Tanker Co. went down the slipway at the Wallsend-on-Tyne yard of Swan Hunter and Wigham Richardson Ltd. on December 23 last. The vessel was named "British Aviator." She is the second "British Aviator" to sail under the BP flag. The original tanker of that name, of 10,762 dwt, was built in 1924. She was the first motor ship to join the company's fleet, and was sold for scrap in September 1953.



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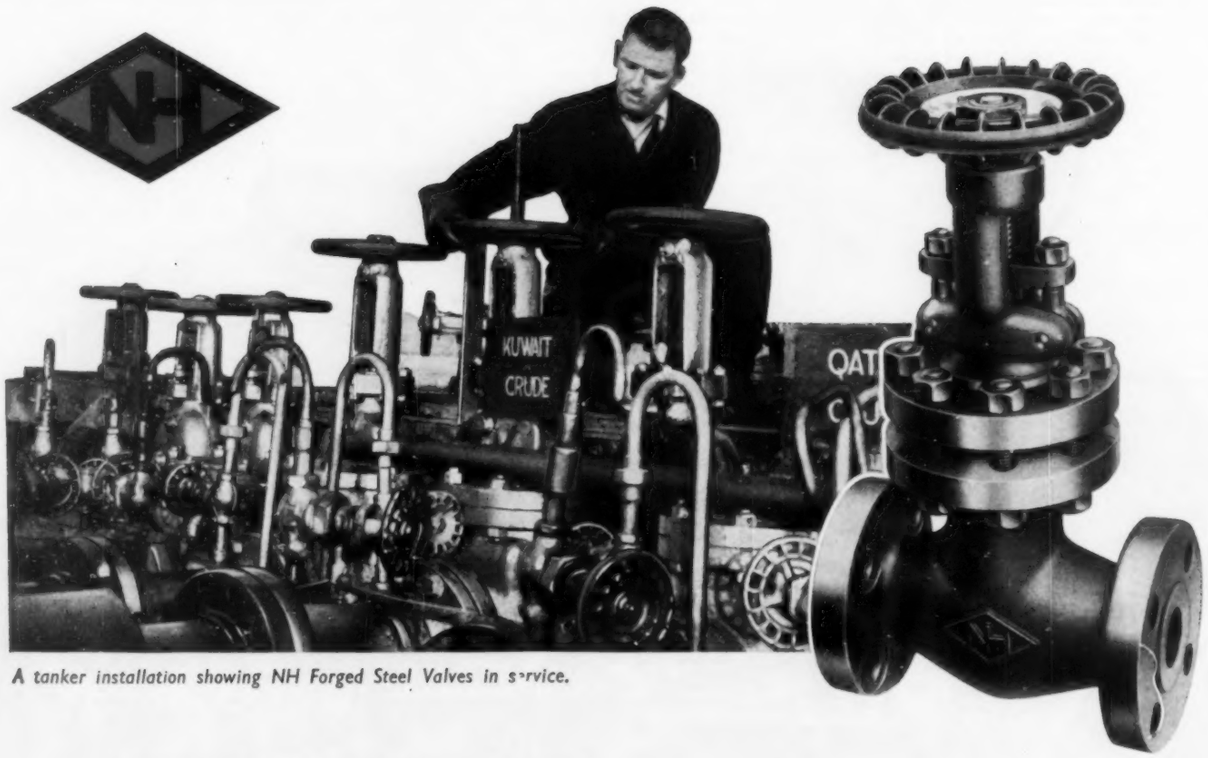

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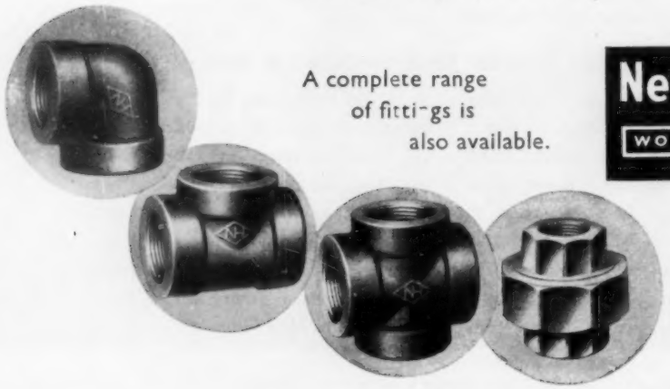

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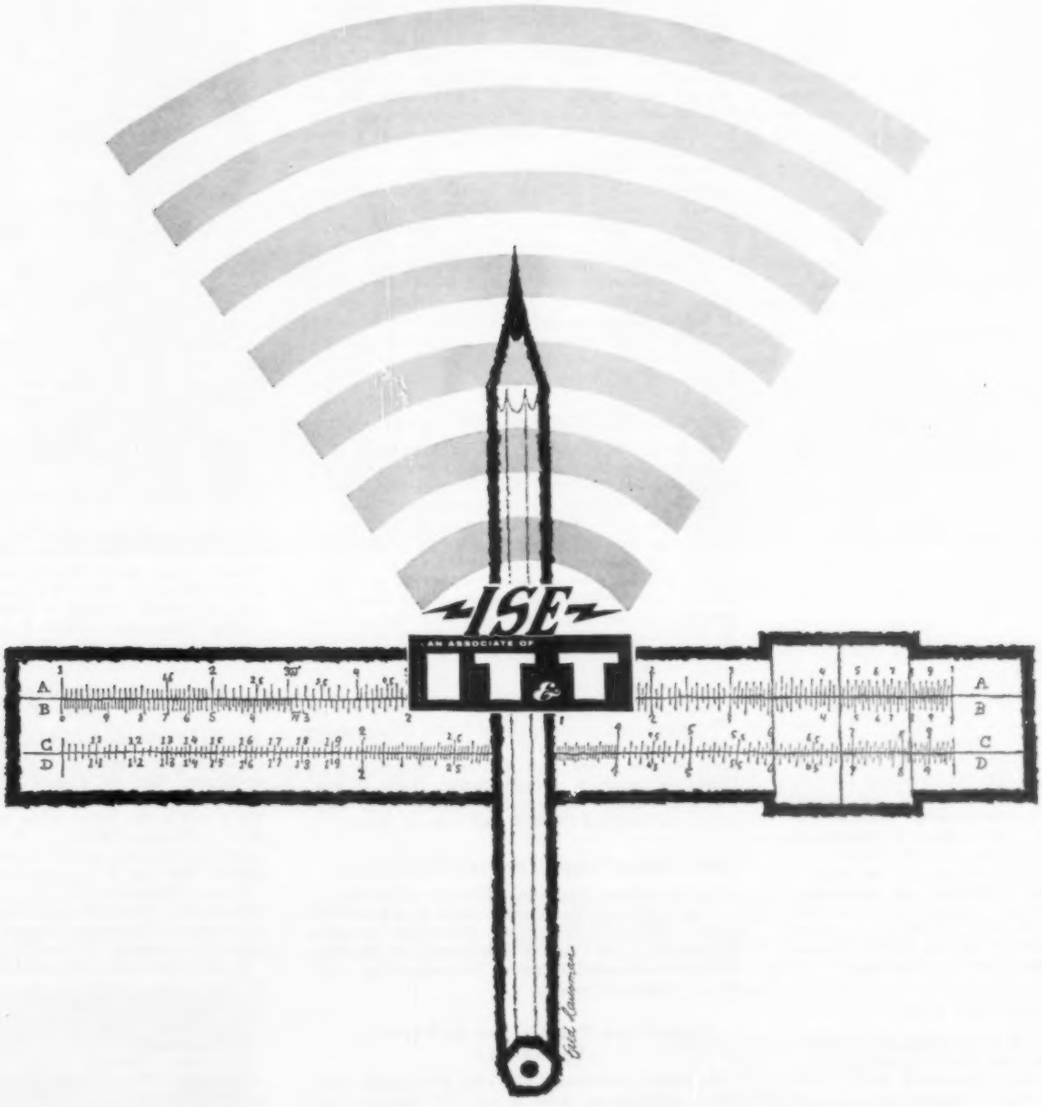


INTERNATIONAL STANDARD ELECTRIC CORPORATION EXPORT DEPARTMENT: 50 CHURCH STREET, NEW YORK 7, N. Y.

LATIN AMERICAN OIL NEWS

To Drill 20 Peruvian Wells

Amotape Oil Co. has an agreement with David M. Grubbs, of Dallas, and a group of Texas oil men to drill 20 oil wells in Peru. Material for first four wells was shipped by Mid-Continent Supply Co. Inc. to Talara, Peru. Amotape's properties are along Pacific shoreline, 40 miles northwest of Talara. They adjoin producing fields of International Petroleum Co. and Petrolera Lobitos, and are adjacent to the area held under similar contract by Peruvian Pacific Petroleum Co., owned by Cities Service and Richfield Corp. Amotape, a USA corporation, presently operates four producing wells through its subsidiary, Petrolera Amotape SA, of Lima.

Pure's New Paraguayan Partners

Pure Oil Co. of Paraguay Inc. is sharing its 23,400-square-mile oil exploration concession in the Chaco territory of northern Paraguay with three additional partners. Pure's new associates are Paraguay Gulf Oil Co., Sinclair Paraguayan Oil Co., and Tidewater Oil Co. William Bros. was Pure's original partner in the concession which was awarded last October.

Under new arrangement, Pure of Paraguay will be the operator and retain a 30% interest. Paraguay Gulf has acquired 25% interest. Sinclair Paraguayan has acquired 15%, and Tidewater 10% from Williams Bros., which retains 20%.

Drilling operations are expected to commence early in June.

Venezuelan Reserves Up 10%

Venezuelan government estimates new reserves discovered in 1957 totaled 2.3 billion barrels—up 10%. Total reserves at year-end were 15 billion.

Venezuela Expands Pipeline

100-mile 30-in. crude-line extension, completed about May 1 by Williams Bros., will loop Mene Grande's Oficina-Puerta La Cruz system and raise capacity by 300,000 b/d to 500,000 b/d. Capacity of existing double 16-in. and 26-in. system is 530,000 b/d. New loop will be operated separately to segregate heavy Mara-type crudes.

Venezuelan Well Abandoned

Venezuelan Atlantic has abandoned Paez No. 2 at 2,478 ft—second dry hole on its Barinas acreage. Paez 1 was abandoned at 9,358 ft.

Brazilian Output to Climb 10½% Yearly

Brazilian oil demand will climb 10.5% a year for the next 21 years—to stand at 1,200,000 b/d a year by 1975, it is estimated. Refinaria Uniao de Capuavas has published a pamphlet giving this figure based on an estimate of 1975 population of 100 million and use of petroleum for 60% of the nation's energy needs. The pamphlet sees "considerable capital" needed in Bolivian oil fields to develop oil supplies which Brazil logically would be drawing on.

An eight-year program, calling for 100 wells a year, and operation of 30 drilling rigs, would cost $179 million, the pamphlet estimates. About $100 million of this would be for a 100,000 b/d pipeline from Santa Cruz, Bolivia, to Santos, Brazil. The rest would be for exploration and development.

Costa Rica Oil Law

No oil concessions will be granted in Costa Rica, other than the existing one, until a general oil law is enacted by the national legislature. Such a proposed law was under study, but no action was expected until the new administration of President Mario Echandi took over, May 8.

Nicaraguan government officials have made similar announcements regarding granting of exploration concessions. However, studies for a general hydrocarbon law are further advanced, and an actual law is now before the Nicaraguan legislature for consideration.

Test offshore drilling in Nicaragua on the Caribbean coast has been discontinued. However, plans are under way to drill onshore in that area this year. Loffland Bros. of Venezuela reportedly will do the contract drilling. Concession holders are a cooperative, headed by a subsidiary of Gulf Oil.

Brazil Fixes 1958 Targets

Crude production in March was estimated at 1,302,000 bbl (42,000 b/d). Petrobras aims to produce 17 million barrels in 1958. Rigs owned by Petrobras totaled 56; number operating in March, 52. 377 Bahia wells were producing oil, and 39 gas; number of offshore producers in All Saints Bay in March was 54. Of 75 wildcats completed in 1957, 51 were producing oil.

Petrobras has started to drill at Olimpia, Sao Paulo, and has extended prospecting to municipality of Piraju, in southern Parana. 1958 exploration will be concentrated on lower Amazon River—along coasts of Maranham, Alagoas, and Sergipe, in Bahia Reconcavo and Parana basin.

Crude processed in Brazilian refineries increased 13.7% in 1957, to 45,032,367 bbl; production of refined products rose 13.0%, to 43,224,000 bbl; internal consumption increased 2.3%, to 71,525,000 bbl. Oil imports cost Brazil US $262,573,000 in 1957, or $17,398,000 less than in 1956. In 1958, builders should start delivery of four 33,000-ton tankers, under construction in Holland, and of three 34,400-tonners building in Japan.

President Kubitscheck says: Existing and projected refineries will raise Brazil's processing capacity to 330,000 b/d by 1960. The refinery now building at Caxias, Rio de Janeiro, will be known as "Duque de Caxias." (The Mataripe refinery is now known as "Landulpho Alves"). Plans to build a 25,000 b/d refinery in Minas Gerais are nearing completion. By June 1958, three privately owned factories will be receiving raw materials from the Presidente Bernardes refinery to produce styrene (capacity 5,000 tons per year), polythlene (4,300), and carbon black (15,000).

SoCal-Gulf Bahamas Offshore Test

Bahamas California Oil Co. and Bahamas Gulf Oil Co. will drill a joint exploratory test on Cay Sal Bank, approximately 180 miles southwest of Nassau. Drilling operations were scheduled to start in April.

The well will be drilled under licenses held by the two firms, wholly owned subsidiaries of Standard Oil Co. of California and Gulf Oil Corp., respectively. Site was selected after two years of extensive seismic work over Cay Sal Bank, at a cost of over $400,000. The well will cost nearly $3 million. It will be drilled to a maximum depth of 15,000 ft from a self-contained platform located in 30 ft of water.

Costa Rican Test Abandoned

Petrolera de Costa Rica, local Union Oil Co. subsidiary, was expected to discontinue drilling at the Liverpool No. 1 well, some 20 miles west of port of Limon. A depth of slightly under 11,000 ft was reached, without encouraging results. Originally, pipe for a depth of 15,000 ft had been on hand.

Argentina Needs Greater Production

Dr. Cueto Rua, Argentine Minister of Commerce and Industry, says the country needs greater efforts toward petroleum production. Otherwise, he said, the country faces "violent restrictions" on imports, reduced standards of living, unemployment, and other economic troubles.

Complete Pirital No. 6, Eastern Venezuela

Pancoastal Petroleum Co. and Venezuelan Atlantic Refining Co. have a new oil discovery on their jointly owned 6,200-acre Pirital concession, in the Punta Gordo area, eastern Venezuela. After an initial test, the new well, Pirital No. 6, was placed on pump with a production of 240 b/d of 19-gravity crude through perforations from 1,210 ft to 1,280 ft. Construction of a feeder line to nearby pipeline facilities is now under way.

Pancoastal and Venezuelan Atlantic, the operator, have also completed the 5th producing well in the recently discovered Aguasay-Caro field. Caro No. 3 was placed onstream as a dual-zone producer at the rate of about 1,000 b/d. Production of the five Caro wells completed to date averages approximately 5,000 b/d gross of 35-gravity oil. Two other Caro development wells, No. 5 and 7, presently are drilling below 11,500 ft, and are scheduled for testing operations. Production at Caro, also located in eastern Venezuela, is found at depths between 12,000 ft and 13,800 ft.

Brown & Root's Barge M-211, one of the largest pipe-laying barges ever built, shown being loaded with two million pounds of equipment and material, destined to lay a submarine pipeline in Lake Maracaibo, Venezuela. The barge was towed from Houston to Venezuela. On arrival at Lake Maracaibo, the barge will lay 72,900 ft of 40-in. concrete-weight coated pipe for Creole Petroleum Corp. of Venezuela.

Bandini in British Honduras

Bandini Petroleum Co., Los Angeles, has announced formation of a wholly owned subsidiary, the Belize Petroleum Co. Ltd., to hold prospecting licenses for exploratory work in Bandini's holdings in British Honduras.

Belize Petroleum will have prospecting licenses on 958,000 acres; a working agreement with West Caribbean Oil Co. on prospecting licenses on an additional 908,000 acres; an agreement with Gulf Oil to acquire another 144,000 acres in leases. All of these properties are located in the southern half of British Honduras, and the combined prospecting licenses and leases will total more than 2,000,000 acres.

Recent photogeologic studies indicate from eight to ten prominent structures in the outcrop area of these holdings. Upon completion of additional geologic work, company plans to drill a test well in the Punta Gorda area. Bandini holdings are immediately adjacent to those of Signal Oil Co., in bordering Guatemala. Geology is similar to that in neighboring Guatemala, where the company has been active for the past two years.

Peru's Amazon Basin Wells Test 500 B/D

The German syndicate associated with El Oriente Co. in the development of the Maquia structure is deepening well No. 6 after finding oil with some water at 1,740 ft. The well is drilling between wells No. 1 and 5—the latter being noncommercial. First three wells tested 500 b/d of 38-gravity oil from the upper Cretaceous sugar sandstone at 2,100 ft to 2,200 ft. Well No. 4 was noncommercial.

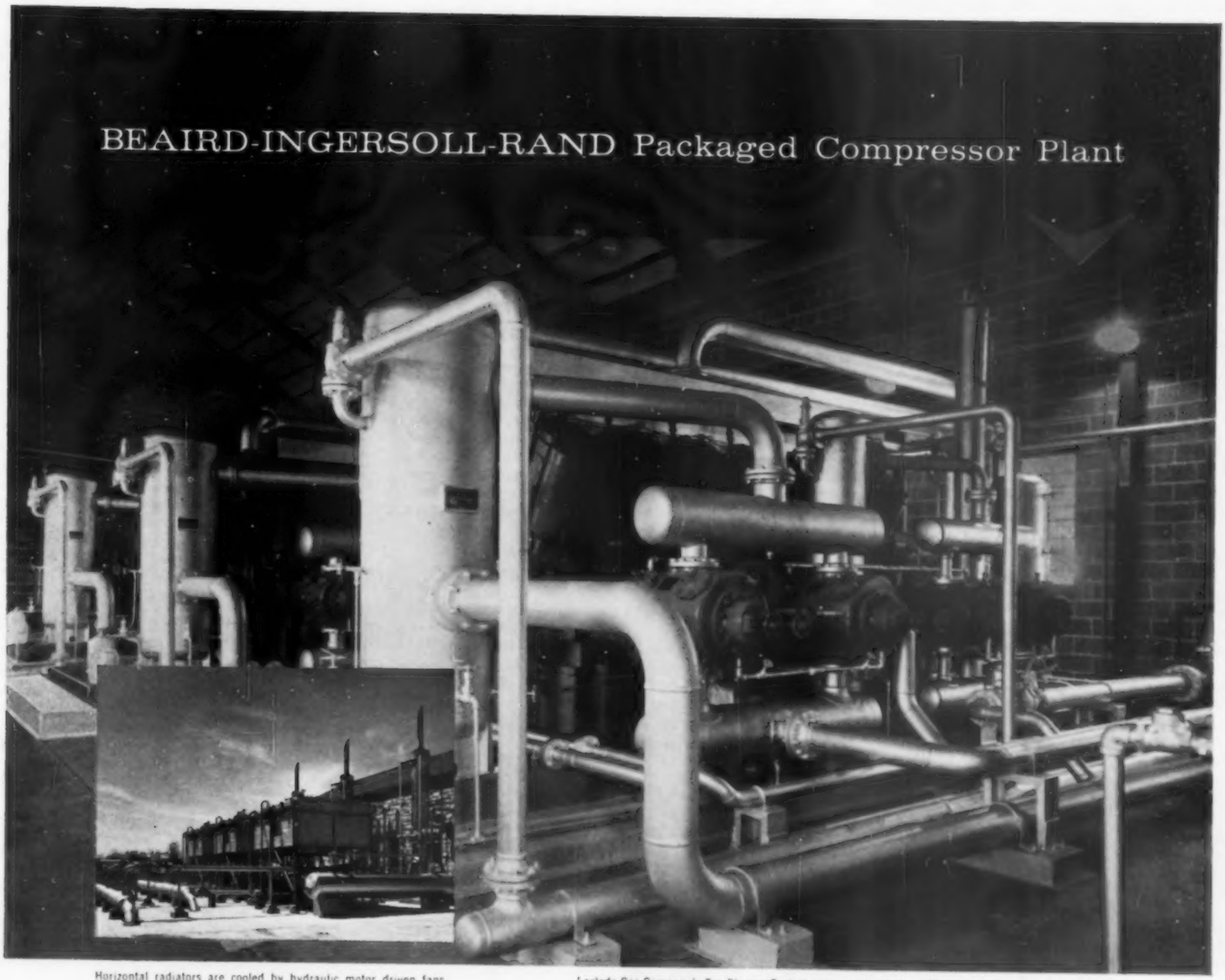
Texas Petroleum Co. has organized (with El Oriente Co.) Petrolera Yurimaguas SA to develop El Oriente's Yurimaguas concessions. Texaco's interest is two-thirds; El Oriente's one-third.

In the coastal area, International Petroleum Co. is drilling a deep wildcat in the northern part of the Lobitos concessions, south of Quebrada Mancora. The company bought a half-interest in Lobitos last year for $18 million.

Petrolera Amotape, American Independent, is preparing to drill 10 wells adjoining Lobitos coastal properties, where two shallow wells have found production in the upper Eocene Verdun formation.

Begins Bolivian Exploration

Andes Oil Co. has begun geophysical exploration in Bolivia, with two parties of 85 workers covering the 499,000-hectare concession. Andes is a subsidiary of Pure Oil Co. Associated in the concession are Standard Oil Co. (Ohio) and Hancock South American Co.



Horizontal radiators are cooled by hydraulic motor driven fans powered by pumps V-belted to sheaves on the end of each engine crankshaft.

Laclede Gas Company's Gas Storage Project—equipped with three Beaird-Ingersoll-Rand 660 h.p. 12SVG packaged compressors. Units have Young radiators with gas, lubricating oil and engine water cooling sections. Other Beaird compressors from 120 to 660 h.p.

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CANADIAN NOTES

Canadian Upturn Seen

The prospect of an "important increase" in the sales of petroleum products and of Canadian crude oil is foreseen by J. R. White, president of Imperial Oil.

In his report to the company's annual general meeting of shareholders, Mr. White made these points: (1) In the opinion of some competent observers, the recession is moderating and perhaps coming to an end. (2) Full development of oil markets in the areas now served by western producers could provide continued adequate incentive for exploration. (3) Subsidies, tariffs, quotas, or government-built pipelines to move western Canadian oil to Montreal would start a "chain reaction" of controls and regulations. (4) Government can assist the industry by depletion-allowance provisions which put the Canadian producer on a par with USA counterparts; and by continuing representations at the highest level in Washington on the import quota question "with emphasis on the future rather than the current situation." (5) By its leadership in developing the markets for Canadian crude, Imperial has proved its readiness to back any sound plan to market Canadian oil, even when it has involved displacement of crude from affiliated companies.

Mr. White felt that the upturn in demand for products and Canadian crude would occur "whether or not we are now at the low ebb of affairs" in the economy generally. The signs were: (A) Heating-oil demand will increase to some extent because of the larger number of customers; and, if weather in the next heating season is normal, it will increase very markedly. (B) With the recession arrested or with conditions improving, industrial demand for heating oils may be expected to resume its growth. (C) Continued, although somewhat smaller, increases in motor-vehicle registrations will improve gasoline demand.

Turbodrill for Canada

Shell Oil Co. of Canada Ltd. will give "turbo drilling" its first trial in Canada when the company drills its Watertown No. 4 well in the mountainous southwestern Alberta area near Pincher Creek. J. W. Roche, area production manager, Calgary, said that in experimenting with turbo drilling, Shell hopes to reduce considerably the drilling time required on surface hole at Watertown.

Asphalt Plant for Imperial

Imperial Oil will built a $1.4 million asphalt plant at its Edmonton refinery to meet growing demand for roofing and paving asphalts throughout northern Alberta and northeastern B.C. Engineering work is already under way, and a contract for construction will be awarded this summer. The 1,500 b/d plant is to be in operation by the spring of 1959.

To Complete Trans-Canada This Year

Approximately 3,000 men will be working this year in the field building the final 853-mile link of the Trans-Canada natural-gas pipeline from Alberta to eastern Canada, according to C. S. Coates, president of Trans-Canada Pipe Lines Ltd. Total cost of 1958 construction will be approximately $165 million. Completion of the line is scheduled for the fall of 1958, when Alberta natural gas will be available to the homes and industries as far east as Montreal.

M. S. BERINGER, retiring president of The British American Oil Co. Ltd., Toronto, has been re-elected chairman of the board. E. D. Brockett, former Gulf Oil Corp. vice president, has been made president and chief executive officer. J. W. Morgan, formerly general manager for manufacturing, has been elected a vice president; and J. R. Yarnell, formerly services manager for B-A's production department in Calgary and assistant treasurer, becomes treasurer.

E. J. GALLAGHER has been appointed general manager, production and pipeline department, of British American Oil Co. Ltd., at Calgary. O. I. tive duties relating to production and pipeline op-TORKELSEN, vice president, will assume executive duties relating to production and pipeline operations—with headquarters in Toronto. E. R. Link has been appointed services manager of the department and assistant secretary of B-A. He succeeds J. R. Yarnell, appointed treasurer with headquarters at Toronto.

Need More Canadian Reserves

According to British American Oil president M. S. Beringer, the oil industry will have to find and develop more new reserves in the next 10 years than have been discovered in western Canada to date. Increase will be necessary to supply anticipated growth in domestic and export demand, and to maintain adequate reserves for the future. Company's long-range forecasts indicate actual crude production in western Canada will more than double in the next decade.

May Re-Open Trans-Canada Contract

If Federal Power Commission accepts recommendation of its own counsel to dismiss application of Midwestern Gas Transmission Co. for import of Canadian gas via Trans-Canada, it is considered possible Trans-Canada will re-open the matter of the contract between Northern Natural Gas Co. and Western Pipe Lines. Trans-Canada disowned this contract for 200 million cubic feet per day when it absorbed Western, but Northern Natural contends it is still valid.

Substitute Domestic Crude

Action by federal and provincial governments in Canada "to create a preference" for Canadian rather than "dictatorship crude" in the Montreal area to pave the way for construction of an oil pipeline to Montreal has been urged by R. A. Brown, Jr., president of Home Oil Co. Ltd. International oil companies, he said, "have been moving their dictatorship crude home in larger and larger volume" to the detriment of crude owned by domestic producers. He contended that the special economic study of Walter M. Levy, New York consultant, had shown that Canadian crude could compete in price with foreign crude in the Montreal area, and that statements by the president of Inter-provincial Pipe Lines Ltd. have supported economic feasibility of a $250 million expansion to serve Montreal.

"There is hardly a single economic aspect of life in western Canada which would not be favorably touched" by results of acquiring the Montreal market," said Mr. Brown.

Alberta-Edmonton Crude Line

Construction is to start in late spring or summer on a 130-mile 10¾-in. crude line from northern Alberta's Swan Hills area to Edmonton. Permission for construction of this new line was received during April by Federated Pipe Lines Ltd., subsidiary of Home Oil Co. Ltd. Cost of the line is estimated at $6.5 million.

Canadian Well Completions Down

Alberta sparked an upturn in well completions in western Canada for March, making an increase over last year for the first quarter, at 411 against 399 wells. Saskatchewan and Manitoba were far down—with 178 and 38 wells, respectively—compared to 288 and 59 last year. British Columbia was up moderately. The Western Canada total was off substantially, at 663 wells—compared to 788 in 1957.

Phillips Consolidates Operations

Phillips Petroleum Co. has consolidated all phases of its operations in Canada, under M. R. HAYES, manager of Phillips foreign-department Canadian operations, with headquarters in Calgary, Alberta.

Canada Buys Canol Line

The 110-mile Canadian section of the 4-in. Canol pipeline, built by USA during World War II from Skagway, Alaska, to Whitehorse, Y. T., has been sold by USA to Canada. Price of the line—which runs between Whitehorse and the Alaska-B. C. boundary—has not yet been estimated by Canada's Department of Northern Affairs. Line will be leased to White Pass & Yukon Railway Co. for operation as a common carrier.

Refineries Along Interprovincial

Instead of placing western Canadian crude in Montreal area. W. Harold Rea, president of Canadian Oil Companies Ltd., proposes more refineries be located along existing Interprovincial Pipe Line, from west to Toronto—with all refineries in Canada in reach of Canadian supply to use the line. Thus the orbit of Canadian crude steadily would move eastward, and in time most of the Ontario market would be supplied by Canadian crude.

For Canadian crude to be competitive in Montreal, he said, well-head prices and pipeline tariffs would have to be reduced—with possible import controls. Also, to retain market, Middle East and South American crude producers might well drop their prices.

Alberta Gas Proposal

The Alberta government is considering a proposal calling for creation of an Alberta gas marketing board which would purchase and sell all Alberta gas. Proposal that the government consider establishment of such a central authority to manage both domestic and export marketing of gas was made by Hugh John Macdonald (Liberal—Calgary) and received unaminous passage in the legislature. Alberta gas would be purchased by the board at prices believed adequate to provide reasonable incentive for development. The resale would insure fair local prices.

Flank to Acquire USA Properties

Flank Oil Co., wholly owned Asamera Oil Corp. Ltd. subsidiary, has contracted to purchase assets of 11 companies engaged in production, refining, and distribution of petroleum and products in the USA Wyoming and Colorado areas. Asamera (formerly New Britain Dominion Oil Co. Ltd.) has announced acquisition by Flank of "all of the assets of the Oriental Refining Co., Denver; Taylor Oil Co., Sheridan Crude Oil Purchasing Co., and other companies in the so-called "Stringer-Zall" group—with headquarters in Denver, Colo."

Purchase involves about 400,000 bbl of crude production the first year; 1,550,000 bbl per year of refining capacity; 3,800,000 bbl of proved recoverable crude reserves; approximately 100 service-station outlets, of which about one-quarter are owned and the balance rented. Substantial amounts of equipment—including drilling rigs and tank trucks—also are involved.

Fort Nelson Gas Find

A gas strike by Pacific Petroleums Ltd. in the Fort Nelson area of northern British Columbia has raised hopes for development of an important new gas area. A spokesman for Pacific said that the strike, approximately 200 miles north of Fort St. John, was made on a tract of 165,760 acres, adjacent to the Alaska Highway. The well, Pacific Fort Nelson No. 1, having already encountered two productive gas zones in the Mississippian, was being carried down at latest reports to test the Slave Point and Devonian formations. In the meantime, the company reportedly has moved a second rig into the area for another test on the acreage. The acreage is held in the name of Pacific and Imperial Oil Ltd.

Interprovincial Profits Down

A decrease in net earnings by Interprovincial Pipe Line in 1957, compared with 1956, has been attributed by the company in its annual report to shorter pipeline hauls and lower throughput than had been estimated for the year.

It was stated these factors resulted in earnings being lower by 1.8%. Net profit was about $9,545,000, compared with $9,725,000 in 1956. Although deliveries of oil were up to 99.9 million barrels from 96.7 million, an oversupply of petroleum products in the latter half prevented the meeting of estimates. Average movement via the Edmonton-Sarnia line was shorter because a higher percentage of crude from Saskatchewan and Manitoba entered the system. The company spent about $23 million in making additions to plant and equipment during the past year.

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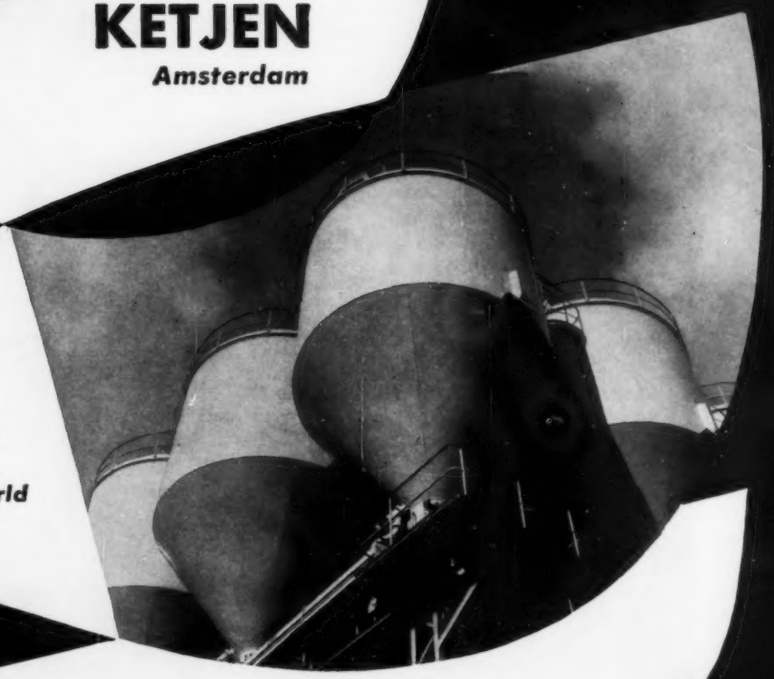

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"Dacron"* an example of volume consumption

Uniforms of DuPont "Dacron" polyester fiber have been widely adopted for service station attendants. The garments are remarkably acid-resistant, can be washed or dry-cleaned, and are unusually durable. What's more they *hold* creases, *resist* wrinkling, *stand up* under the rigorous routine of the busy service station.

Huge quantities of other synthetic fibers, such as nylon, also are made from oil. In fact, petroleum products have in recent years become such an important source of raw materials that many chemical companies, DuPont included, have located plants in refining areas so as to be near an ample source of petroleum-derived raw materials.

*"Dacron" is DuPont's registered trademark for its polyester fiber.

When sludge fouls oil storage tanks, filters, strainers, lines and nozzles, there are two remedies. One is to remove the sludge mechanically and manually. This means downtime and considerable other expense.

The alternate way is to clean the system chemically. This is far cheaper, and there's *no downtime* involved.

The economy and effectiveness of this method are exemplified by a recent case history:

DuPont FOA-2 is added to residual fuel as it's pumped into sludge-laden tank.

A power plant serving two industrial laboratories burns between 1,000 and 1,500 gallons of residual fuel daily, drawn from a 50,000-gallon storage tank.

6 inches of sludge

Recently, it was discovered that six inches of sludge had accumulated in the bottom of the tank.

A tank cleaning firm was called in. A firm estimate of $800 was obtained for cleaning the tank mechanically. Considerable downtime would be required.

But since a constant temperature

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

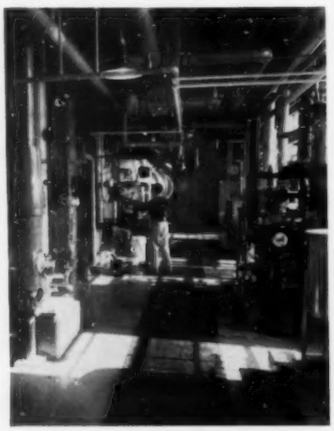
CONTINUED

$20 Saves $800

had to be maintained in the laboratories, the power plant could not afford the downtime. Looking for an alternative, the power superintendent decided to try dispersing the sludge with Du Pont Fuel Oil Additive No. 2 (FOA-2).

Constant operation

$20 worth of FOA-2 was added with the next load of fuel oil delivered. A week later, no sludge could be detected. And the tank was in continuous use during the clean-up period.



THIS IS THE POWERHOUSE that *had* to maintain service, so that essential temperature control, in the laboratories it served, could also be maintained.

At the end of the week, throughout which time boiler room operations were completely trouble free, it was found that the entire sludge accumulation had been dispersed and burned with the fuel.

Sludge prevention

In addition to sludge removal, *prevention* of sludge formation is another important function of Du Pont FOA-2. It is an excellent stabilizer and solubilizer, as well as a dispersant, for all types of fuel oils.

Being nonmetallic, this additive burns completely with the fuel, leaving neither ash nor other residue.

For more detailed information about Du Pont FOA-2 and its use as a tank-cleaning agent, get in touch with one of our sales offices listed at right. They have a new FOA-2 booklet, and Technical Memorandum 317 which contains a number of case histories.

How one refinery solves residual sludge problems with Du Pont FOA-2

In the heating plant of a midwest refinery, residual fuel with 40% BS&W, most of which was "coke," was being used. Frequent cleaning of the storage tank was required to prevent the nozzles from clogging and the burners from flaming out.

FOA-2 tried

Following one of the clean-outs, Du Pont Fuel Oil Additive No. 2 (FOA-2) was added to the incoming oil stream to disperse sludge residue and stabilize the fresh oil supply.

BEFORE FOA-2—This picture shows a typical instance of nozzle fouling caused by sludge in residual fuel.

AFTER ADDING FOA-2—Nozzles stay clean, burner operation is improved, and tank contents remain free of sediment.

The results were gratifying. After the additive was used for three weeks, there was no detectable sludge in the storage tank. Normally in this length of time the sludge level would have built up in the tank sufficiently high to cause pumping difficulties.

Flame pattern improved

When the burners were examined, the flame pattern was found to be better. Also, fewer ash deposits were found in the furnace and the over-all burner operation was improved.

This money-saving improvement and the elimination of frequent, costly cleanings resulted from the highly efficient dispersing, stabilizing and solubilizing qualities of Du Pont FOA-2. It can equally well improve the distillate fuel oils you sell or use yourself.

A recently-published booklet on FOA-2 contains all the basic information on the many varied applications of FOA-2. There is also a bulletin of case histories that you will find of interest — our Technical Memorandum No. 317. You can obtain this literature by writing or contacting the nearest Du Pont Petroleum Chemicals Division sales office.

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OVER

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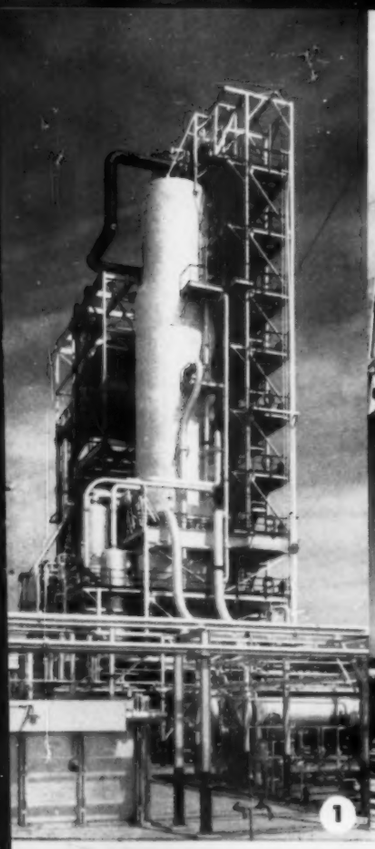
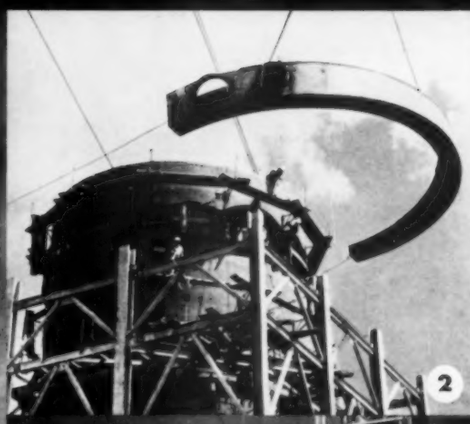
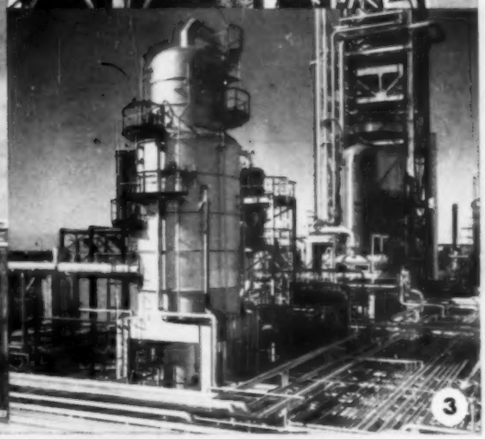




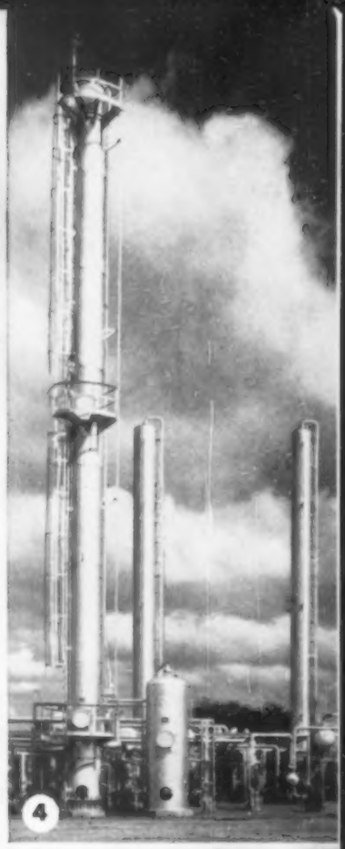


1. 9-ft. diam., 116-ft. high fractionating tower built for Creole Petroleum Corp. Ltd. at Amuay Bay in Venezuela.

2. Air duct section for *first* type TCC Thermofor unit built, is raised at Capuava Refinery in Sao Paulo, *Brazil.*

3. 63-ft. high vacuum column partially clad with 405 stainless steel built by CB&I for Petroleo Mexicanos Minatitlan refinery.

4. Gasoline stabilizer, high and low pressure absorbers and oil still—just a few of the extensive CB&I-built equipment erected for Phillips Oil Company at San Roque, *Venezuela.*



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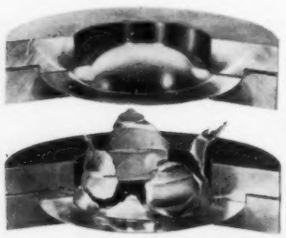

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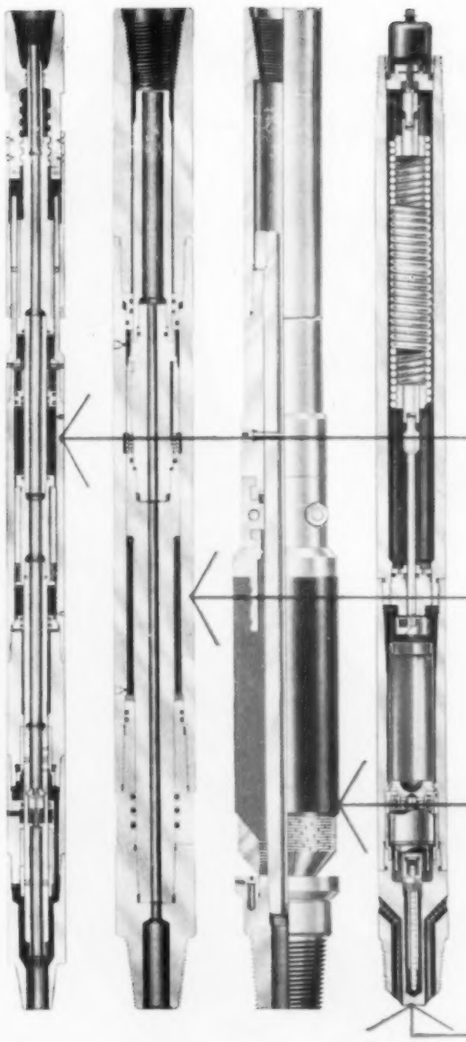

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Simple fact: without the power of oil and the products of oil research, farmers could not adequately feed our country.

The next time you hear somebody who knows little about oil talk against the oil industry, speak up. Tell him the facts, tell him you're an oilman and you're proud of it. And tell him why.

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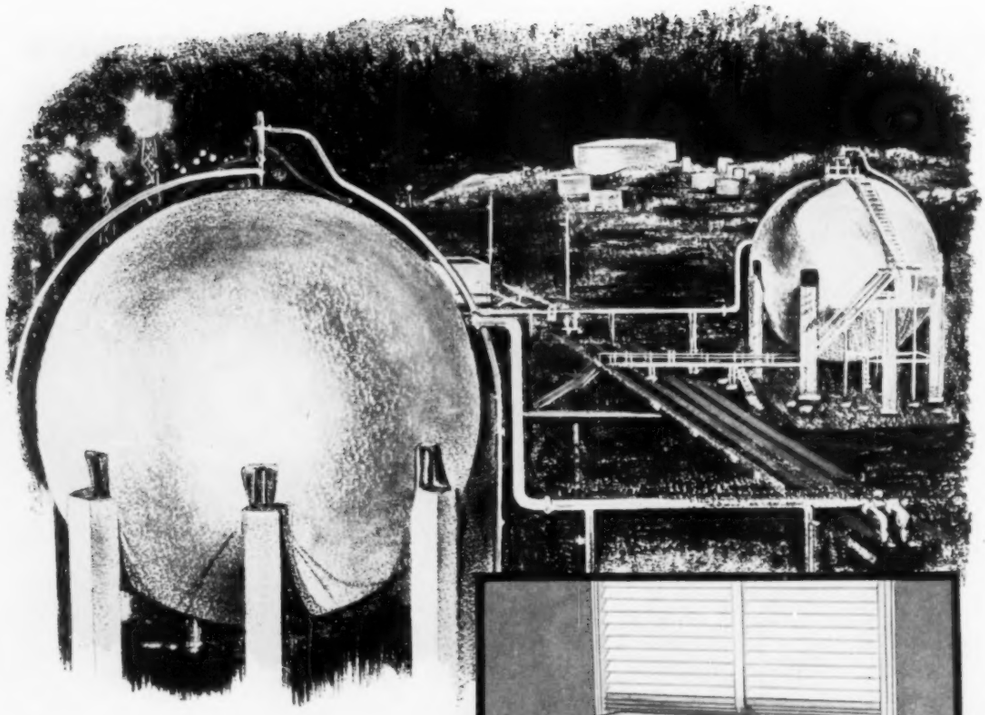

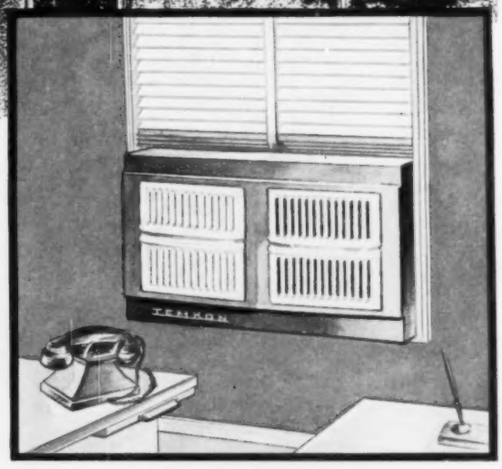

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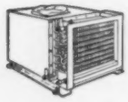

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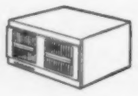

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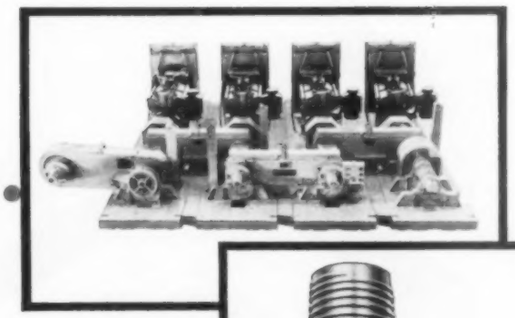

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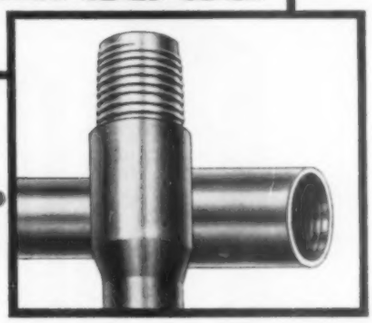

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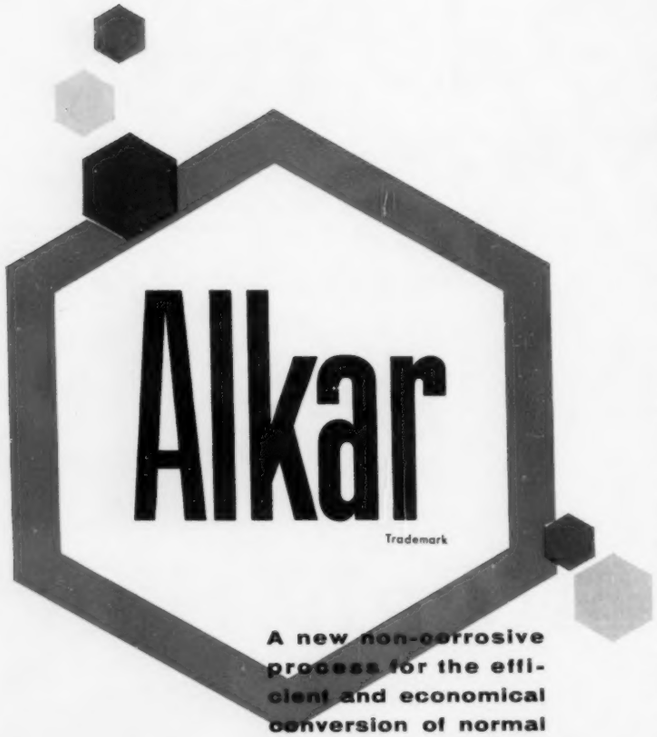

A new non-corrosive process for the efficient and economical conversion of normal butane to iso-butane

Butamer, now being made available to refiners by Universal Oil Products Company, will help meet the increasing demand for iso-butane.

Development by UOP of a special platinum-containing catalyst permits the efficient production of iso-butane especially as feed for alkylation processes.

Minimum initial investment for Butamer installations is achieved as its flexible design permits economical integration with alkylation units.

Mild operating conditions are used in the Butamer process resulting in little loss to by-products.

Butamer is one of many UOP petrochemical and refining processes available to refiners everywhere. We will be glad to provide full information on this or any other UOP process without obligation.

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More Than Forty Years Of Leadership In Petroleum Refining Technology

New UOP Petrochemical and Petroleum Processes Now Available To Refiners

Two new processes, Alkar and Butamer, recently announced by Universal Oil Products Company, offer a great potential for helping refiners secure maximum profits from their operations. Alkar provides the refining industry with a practical means of enjoying the increasing market for petrochemicals with minimum capital investment and profitable operational ratios. Butamer offers the refiner an economical method of securing isobutane.

The Alkar process permits the utilization of the light olefin content of fuel gas on a much larger scale than has previously been practical for the average refiner. The recovery of this by-product olefin from off-gas streams has been frequently impractical because of the very substantial investments necessary for separation equipment. In the development of the Alkar process, UOP worked on the premise that great economies would result if the by-product olefin could be chemically converted without the necessity of prior concentration. The accomplishment of this with the Alkar process now makes it possible for many more refiners to enter the petrochemical field.

The Alkar process is based on the use of a completely new catalyst. This catalyst, in solid form, is used as a fixed bed in reactors of conventional design. The catalyst being non-corrosive, the use of expensive alloys in reactor construction is unnecessary. It is stable against conditions normally encountered in processing and in the handling required in loading the reactors. Catalyst costs are low and special catalyst handling equipment requirements are at a minimum.

Another potential application of the Alkar process provides for the upgrading of fuel gas value olefins to premium octane motor fuel. This is accomplished by the use of the Alkar process to react the olefins with aromatics produced by catalytic reforming.

The Alkar process is but one of a number of petrochemical processes UOP makes available to the refining industry. For many years UOP's research and engineering staffs have been actively developing processes

Alkar and Butamer processes increase refining profits with minimum investment

which yield valuable chemicals from petroleum raw materials and refinery by-products. To provide a broad range of processes for a refiner's every need, Universal also licenses several processes originated by others. UOP petrochemical processes available to refiners include . . . Catalytic Condensation . . . Olefin Extraction For Butylene Recovery . . . Catalytic Dehydrogenation . . . Hydrar* . . . Udex® (originated by Dow Chemical Company) . . . Two-Stage Unifining* . . . Arosorb* (originated by Sun Oil Company).

The Butamer Process

The Butamer process fills the need for an efficient and economical method for converting normal butane to isobutane. This process is particularly important at this time because of the growing demand for isobutane resulting from the increasing use of alkylate for blending into motor fuels.

This process is the result of extensive UOP research and development to secure an improved normal butane isomerization technique. The accomplishment makes it possible for refiners to have, at minimum capital investment, a practical and profitable means for normal butane isomerization.

The basis of this process is the development of a stable and rugged catalyst, capable of operating at relatively low temperatures. Low temperature operation is essential so that the concentration of isobutane in the effluent from the reactor will be sufficiently high to eliminate excessive recycle of normal butane.

Data obtained with the platinum-containing Butamer catalyst show that temperatures in the range of 600° F. to 850° F. will produce an equilibrium concentration of isobutane in the total butane effluent ranging from 49% to 40%. The process is operated under hydrogen pressure.

A low hydrogen-to-charge ratio is used. The high activity of the catalyst makes it possible to operate the process at economical liquid hourly space velocities. This makes possible a reasonable catalyst inventory.

UOP will be glad to supply, without obligation, individual recommendations for the practical application of its various petrochemical processes to any refining operation, anywhere in the free world.

*Trademark

A new process for the economical and efficient upgrading of fuel-gas olefins to high value alkylaromatics

Alkar, now being made available to refiners by Universal Oil Products Company, provides the first economical means for the efficient use of ethylene without costly prior separation.

Diversification of refinery products is attained by use of this process through channeling a portion of total output into the important new markets created by the growing demand for petrochemicals.

The favorable economics of Alkar processing allow application of this technique in all sizes of refineries, thus permitting entry of new operators into the petrochemical field.

Alkar is one of many UOP petrochemical and refining processes available to refiners everywhere. We will be glad to provide full information on this or any other UOP process without obligation.

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OIL COMPANY STAFF CHANGES

A. W. Baucum

J. H. Rambin, Jr.

J. HOWARD RAMBIN, Jr., has been elected senior vice president in charge of Texaco's worldwide producing interests and activities. Succeeding Mr. Rambin as vice president in charge of the domestic producing department is A. W. BAUCUM. Both will be in New York.

GEORGE C. MERRICK has been named manager of industrial relations for Pan American International Oil Co.—with headquarters in New York. He was formerly employee-relations supervisor for Pan American Petroleum Corp., in Tulsa. In his new assignment, he will be responsible for employee and public-relations activities of Pan American International. A native of Evanston, Ill., he is a Yale graduate, and first joined Pan American in 1940.

LOREN F. KAHLE has been appointed transportation coordinator for Standard Oil Co. (New Jersey), New York—succeeding J. J. Winterbottom, recently elected a vice president and director of Esso Standard Oil Co. J. M. B. Howard, assistant transportation coordinator, replaces Mr. Kahle as deputy coordinator.

JAMES R. GORDLEY is the new controller and William E. Jetter is head of a newly created tax department for the American Oil Co., New York.

A. C. MATTEI, president of Honolulu Oil Corp., has been elected chairman, and L. A. Cranson, executive vice president, has been elected to succeed Mr. Mattei as president and chief executive officer.

JOHN L. BIBLE, of Houston, has been elected executive vice president, and Elmer F. Blake, of Denver, Colo., vice president, of Southern Geophysical Co.

Dr. EDWARD W. HARD has been appointed geophysical coordinator, in the geological department of Sun Oil Co.'s Southwest Production Division—with headquarters in Dallas, Texas. He replaces Lee Smith, who recently transferred to Venezuelan Sun Oil Co.'s Caracas office.

Succeeding Dr. Hard as regional geologist at Dallas is Ross H. Ley—formerly at Midland, Texas. Advancing to division paleontologist, with offices at Sun's production research laboratory at Richardson, Texas, is John Means—succeeding the late Dr. I. B. Hamilton. Succeeding Mr. Ley as district geologist at Midland, Texas, is Fred Smyth, formerly assistant district geologist.

FRANK J. BENNAR has been appointed assistant manager of International Petroleum Co.'s marketing operations in Peru, with headquarters in Lima.

Mr. Bennar joined International in December 1956. He has been assistant marketing coordinator in the company's executive office in Coral Cables, Fla.

Carl L. Turkington has been named to replace Mr. Bennar in Coral Cables. He is presently on special assignment, in Bogota, with Esso Colombiana SA, International's marketing subsidiary.

P. C. BARBOSA and C. J. Griffin, both veteran oil men in Latin America, have been elected vice presidents of Esso Standard do Brasil Inc., marketing affiliate for Standard Oil Co. (New Jersey).

Mr. Barbosa, who has held various sales positions with the Brazilian company for 27 years, became sales manager in 1944, and elected to the board in 1950. Mr. Griffin, a director of Esso Standard Oil SA in Havana since 1956, has worked for Jersey affiliates in the Caribbean for 24 years. After 15 years with the Lao Oil & Transport Co. Ltd., refinery at Aruba, he transferred to Esso's Belot refinery as superintendent in 1951. He entered marketing at Havana in 1933, and three years later became division manager.

Dr. WILLIAM E. HUMPHREY has been appointed vice president in charge of petroleum exploration, and George Ware Knight vice president in charge of European activities, of Pan American International Oil Co.

Dr. Humphrey's experience in international oil activities includes many years in petroleum exploration in Latin America, Europe, and the Middle East. He was formerly vice president of the T.U.L.M. Corp. of Houston, Texas.

Mr. Knight, formerly with Gulf Eastern in London, has been active in oil operations for 20 years in Latin America, the Middle East, and Europe.

H. A. SHABAKER, of foreign operations engineering staff of Houdry Process Corp., Philadelphia, has been appointed technical assistant to Theodore A. Burtis, president. Alexander K. Logwinuk, senior process engineer, succeeds Mr. Shabaker in foreign operations.

FRANK A. GOERNER has been named superintendent of production for San Jacinto Petroleum Corp., Houston, Texas, domestic production operations; and Richard B. Hohlt, a widely known exploration geologist, has been appointed chief geologist.

CLARE D. GARD, who retired in 1957 as chief process engineer of Union Oil Co. of California, was presented with the Hanlon award at the 37th annual convention of the Natural Gasoline Assn. of America, at Dallas. Mr. Gard is the 22nd recipient of the award, which is conferred each year by the NGAA for outstanding service to the natural-gasoline industry. Donor of the award is E. I. Hanlon, chairman of the National Bank of Tulsa, and a pioneer in the natural-gasoline business.

LOUIS DAVIGNON, special assistant at Dallas for Sun Oil Co., has been assigned to work with Venezuelan Sun Oil Co.—with offices at Maracaibo, Venezuela. William Ferrell, of Sun's industrial-relations department, succeeds Mr. Davignon as special assistant in the Dallas office. Mr. Davignon will retain his title as special assistant, industrial-relations department for production.

PAUL D. BALBIN, formerly of Tulsa, has been appointed chief geophysicist for Chaco Petroleum SA, Bolivian subsidiary of Tennessee Gas Transmission Co. Chaco Petroleum is the operator for a group of USA companies conducting exploration operations on an extensive lease near the Bolivia-Argentine border.

JOHN W. BUTLER has been appointed representative of Phillips Petroleum Co.'s foreign department in Paris, and will be engaged in the company's activities relating to recently acquired concessions in the Sahara desert of Algeria. J. T. CLARK has been named to succeed Mr. Butler as chief geologist in Caracas, Venezuela. Mr. Clark had been manager of the company's Amarillo, Texas, land and geological division.

VICTOR R. FARLOW has been promoted to director of petrochemical sales, effective April 1, of Gulf Oil Corp.

Dr. GEORGE W. BESTE has been appointed general manager of research and development operations at Ethyl Corp.'s manufacturing plants. Dr. PAUL A. McKIM, has been named assistant general manager under Dr. Beste. PAUL E. WEIMER becomes director. RUSSELL L. HUDSON was appointed assistant director of research and development services. N. G. ADAMS becomes supervisor of the instrument group.

W. A. "Bill" DAVIDSON, a veteran of over 20 years in industrial sales, has been appointed a special sales representative for Herb J. Hawthorne Inc., manufacturer of rotary bits used worldwide in the exploration drilling industry. Mr. Davidson's appointment was announced by Jack W. Thigpen, sales manager of the rapidly expanding Houston organization, as another planned step in the company's broadening marketing program.

J. E. Bounds

B. R. Dorsey

A. D. Gray

I. G. Davis

Gulf's New Vice Presidents

Gulf Oil Corp., Pittsburgh, Pa., has designated a new senior vice president and elected three new administrative vice presidents. Archie D. Gray, formerly vice president and counsel, now is senior vice president. The three new administrative vice presidents are Joseph E. Bounds, for tax department; I. G. Davis, for production; B. R. Dorsey, for manufacturing.

Mr. Gray became associated with Gulf's law department in Houston in 1935. He became general council in 1956, and a vice president in 1957.

Mr. Bounds, who joined Gulf in 1929, has been general manager of the tax department since 1955.

Mr. Davis—since 1956 president of Mene Grande Oil Co., Gulf's Venezuelan subsidiary—joined the organization in 1935. In 1940 he transferred to the geological department in Caracas, and in 1946 became assistant to the division manager at Maracaibo. He was named vice president in 1951.

Mr. Dorsey, previously coordinator in the manufacturing department, joined Gulf at Port Arthur in 1940. In 1948 he transferred to Puerta La Cruz, Venezuela, as manager of Venezuela Gulf Refining Co.—returning to Pittsburgh in 1955.

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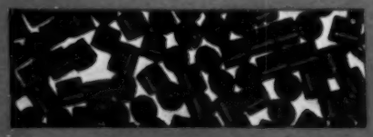

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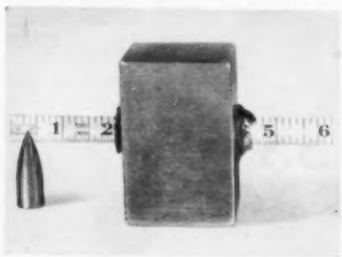

Illustration above shows a 2½" steel test sample pierced by an improved ½" Ogival Bullet fired by a McCullough M-3 Bullet Perforator.

McCullough Sectional Gun Gains Penetration Where Previous Attempt Failed

Depth of operation was only 1487'. 4½" O.D. casing had been cemented in 10¾" hole. Pay zone was bullet perforated by another service company but the formation would not break down. During the attempt to fracture, the pipe split above the zone and collapsed in the perforations.

Operator swaged out the 4½" casing, ran a 3" liner inside the 4½" and cemented the annulus. This operation made an impressive amount of steel and cement to be penetrated to gain production.

McCullough shot 20 improved ⅜" Ogival Bullets in the zone and the formation broke down at 800 lbs. Time on the job was one hour. Results, a good well and a satisfied oil man.

McCullough Sectional Guns are available in 1⅛" O.D., 1¾" O.D. and 2¼" O.D. sizes.

Powerful M-3 Guns Increase Production 316%

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This was a shallow, low production field. The well had previously been perforated by another service company with shaped charges for a settled production of 12 barrels of oil per day.

Productive interval lay between 3837' and 3872' and was cased with special 7" O.D. 51 lb. casing. Casing was cemented in 9¾" hole through the pay zone.

Although skeptical of the ability of any bullet perforator to gain effective penetration through the extra heavy casing and thick cement sheath, the operator called for McCullough M-3 Bullet Guns.

McCullough Service Crew made three runs with 4¾" O.D., 20-shot M-3 Guns, firing 140 improved ½" Ogival Bullets, four per foot, in the 35' zone.

Production increased from 12 to a settled 50 barrels of oil per day—a gain of 38 barrels. The job required two hours, including rigging up and tearing down. To quote the operator, "Results were very satisfactory and gratifying".

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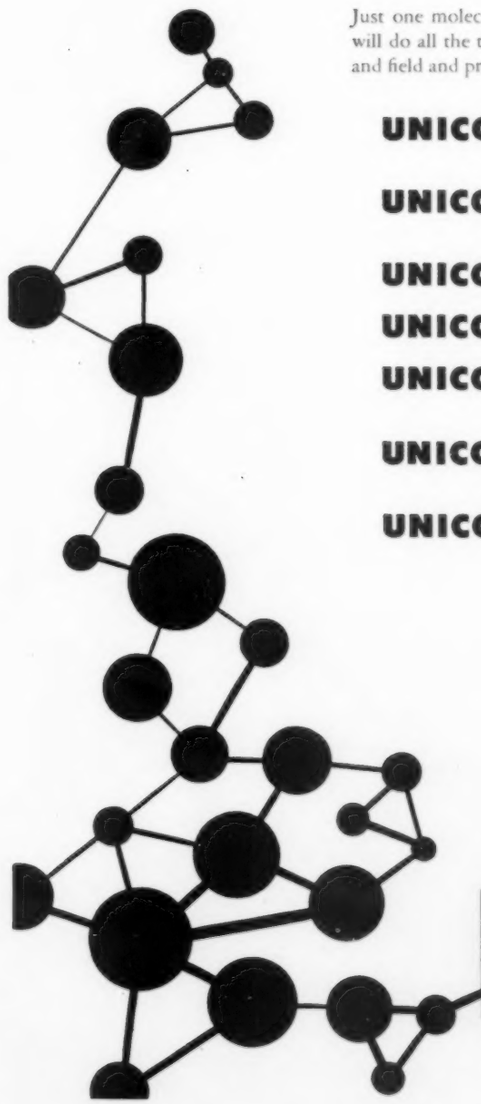

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Danger Ahead

In times of stress—when markets do not expand so rapidly as had been anticipated, and when low-cost competition threatens to reduce or eliminate profits—it is easy to turn to government for protection. This is particularly true in the petroleum industry, because it is an industry which is vital to the national defense in time of war and a prime source of low-cost energy in time of peace. Oil is essential at this stage of the world's history for the improvement of man's standard of living. It is likely to be almost equally essential for many generations to come.

Responsible government leaders are particularly sensitive to pleas for protection because of the public interest in petroleum. Some politicians are sensitive to demands for aid because they recognize an opportunity to make political capital in one way or another.

There can be no question about the power of government to step in on its own, or at the request of the industry. It has the power to shut out foreign competition through embargo. Since the power to tax is the power to destroy, it is clear that government can erect tariff barriers which will effectively shut out petroleum coming from other countries.

When an industry seeks government aid in preventing the free flow of commerce, there are certain results which are inevitable. The law of supply and demand is abrogated. Supply is limited, and prices are above the level which would be reached without artificial means. To a varying extent, consumption is restricted. The effect of artificial barriers may easily be seen by a comparison of the per-capita consumption of oil with the import duties and internal taxes levied in various countries. For many years, the petroleum industry has sought to restrict taxes on gasoline to road purposes because of the effect higher taxes have on consumption.

Particularly in the United States, the first result of any interference with free enterprise is government control to some degree. The philosophy of government is that an industry must be regulated as a protection to the public if it is to be permitted to operate outside the law of supply and demand. Controls may be mild and beneficent at the outset, but bureaucracy has a habit of growing. A government activity is very difficult to kill once it gets started, no matter how many Hoover commissions may recommend economies or the axe.

It must be admitted also there is a great deal of inertia in government. Take the natural-gas industry as an example. The average price of natural gas at the well head in Texas today is about nine cents per thousand cubic feet. This is roughly equivalent to 54 cents per barrel crude oil in terms of energy value. The price of gas is not much more than a sixth of the price of crude oil.

Gas producers are doing their best to build sales to local industries which can accept the fuel before it crosses a state line. Such sales can be made today on an arm's length basis, without government approval or interference, at nearly three times the average price of nine cents per thousand. Making a sale in interstate commerce is fraught with delay and expense, and still must be made at prices which most producers think unreasonably low. Every gas producer is against government control and in favor of the free-enterprise system.

The oil industry has had its experiences with government controls during the NRA days, and during national emergencies such as World War II. Before asking the Congress to enact legislation at the present moment, the industry may well pause to ask itself whether results to be obtained will be worth the cost. Will it not be better to make a sincere effort to live under the President's "voluntary" program than to forge chains which may prove difficult to break when demand turns upward and imports are needed in greater quantity? Most students of the industry agree that the United States must rely on foreign sources to an increasing extent in future years, and that the present surplus is temporary. The industry will avoid future danger of control if a spirit of compromise prevails.

Brazil's oil potential — an economic and geologic evaluation

by Dr. John O. Nigra

BRAZIL is one of the largest countries in the world. In area, it is larger than the United States; yet its place among the world's oil-producing nations is at the bottom of the list. Brazil's present oil production of approximately 35,000 b/d—a threefold increase in output since the previous year—represents a step-up of output in the Bahia region, its only more-than-token currently producing area. Comparing this figure with the 7.5 million b/d and the 3.2 million b/d produced in the United States and Venezuela, respectively, one wonders reasonably why Brazil produces so little oil. Does it have petroleum reserves yet untapped? If so, how much and where?

The chronological cycles of Brazil's economy, since its discovery in 1500 by Cabral, are well known . . . . . sugar, gold, cotton, rubber, and finally, now, coffee. Respecting the place of minerals in the present economy, the consensus can well be expressed by W. D. Johnston, Jr. (1954)* who believes . . . . "that the mineral deposits of Brazil can form a basis for a thriving mineral industry capable not only of supplying the internal economy of the country, but also of earning, through export of surplus minerals and mineral products, foreign-exchange credits of the same magnitude as those now earned by exports of coffee." However, anyone who looks to crude oil and natural gas (as so many Brazilians are inclined to do or led to believe) as future commodities which shall take their place among those already indicated as having buoyed the national economy, is doomed to disappointment. Minerals, yes, as was so well established during World War II—particularly iron ores, ferro-alloy metals, bauxite, phosphates, quartz, and feldspars. But not petroleum!

Today, Brazil imports more than 90% of its domestic crude requirements. With the exception of a small, newly constructed (onstream January 1957) refinery in Manaus, 1,000 miles up the Amazon, Brazil's oil is refined along the Atlantic seaboard, where the heaviest population concentration is found. The area of Brazil is 3,288,045 square miles; and, according to the 1950 census, there are 52,645,000 inhabitants. Current population is estimated at more than 58 million. Nonetheless, there has not been any great change in population distribution. With the development of the larger coastal cities such as Sao Paulo, the shift, if anything, has been even more disproportionately away from the interior of the country. Possibly, in more than two-thirds of Brazil —comprising the north, central, and western interior area—there is an average population density of less than one person per square mile.

As might be expected, lines of communication, though existent, are poor in the great interior expanse of Brazil. Except for a narrow-gauge railway which goes from Sao Paulo into southern Mato Grasso, highways and railroads are lacking. Even fair-weather farm roads are few and far between. Perhaps, if the Brazilian *bandeirantes*, like the American pioneers, had had the incentive to push westward to the Pacific, the transportation situation in vast Brazil would be different today. Apart from a few navigable rivers such as the Amazon and Rio Sao Francisco, the only link be-

Dr. John O. Nigra, consulting geologist, Los Angeles, Calif., received his undergraduate degree at the School of Mines, University of Texas, in 1937; M.S. from California Institute of Technology, in 1946; Sc.D. from Graduate School of the University of Mexico, in 1951—based largely on his research and dissertation on the middle Cretaceous of Mexico, with emphasis on the Tampico embayment. He has done additional graduate studies at Texas A. & M.; University of Michigan; and University of California, in Berkeley.

Dr. Nigra's professional experience has varied between industry and teaching. He worked as a subsurface geologist in Venezuela for Standard Oil Co. (N.J.), and as a field geologist for The Texas Co. in Colombia; and then returned to California to work as an engineer for Bethlehem Steel and the Barnsdall Oil Co. during the war. He was a teaching fellow at Cal-Tech, an instructor at Pasadena City College, and headed the department of petroleum technology at Orange Coast College (Calif.) during 1945-50. Returning to industry, he was a research geologist for Aramco until 1952, and then accepted an associate professorship in geology at Tulane University, and resigned in 1956. In 1954-55, he was awarded a post-doctoral Fulbright research fellowship and lectureship to Iraq. Subsequently, he was offered a grant by the Department of State to enable him to accept a visiting professorship in geology at the Universities of Rio Grande do Sul and Pernambuco in Brazil, from where he has recently returned. Dr. Nigra has contributed articles and scientific papers to professional journals.

* *U.S. Geological Survey (chief of Part IV, geological teams), foreign division.*

Portable drilling well at Candeias oil field (discovered in 1941), a few kilometers inland from northern edge of Bahia de Todos os Santos.

tween the populated coastal areas and the far-reaching interior of the country is a well organized system of aerial routes served by efficient, nonnationalized airlines, second in scope among other nations only to those in the United States.

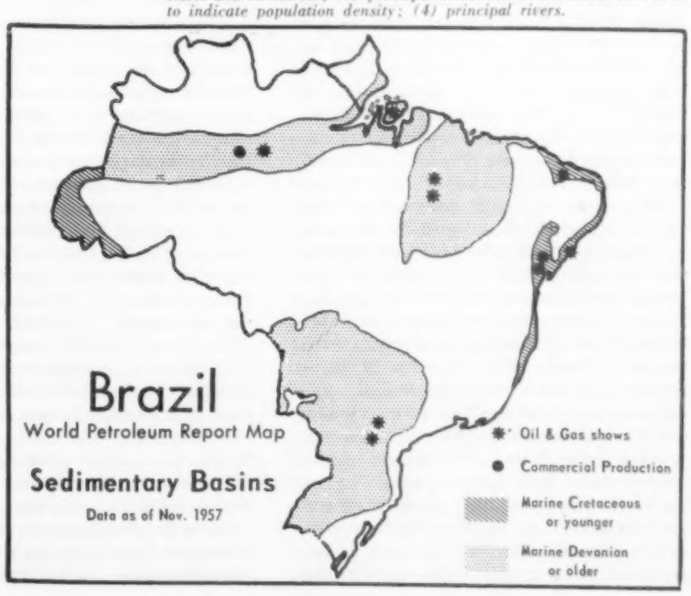
The Amazon jungle is, of course, synonymous with the Brazilian heartland. This equatorial region is a vast expanse of green, luxuriant, heavily matted rain forests, relieved only by numerous floodways and brown silt-laden, digitate tributaries to the main course. These streams drain from the Andean foothills to the west, from the Guianan highlands to the north, and the Mato Grosso to the south—flowing ultimately into the world's greatest deltaic area. Just north of the Tropic of Capricorn —making up another great hinterland, though not entirely so inhospitable as the Amazon—is the region drained southerly by the Paraña and the Uruguay Rivers and their tributaries which flow into the estuarine area of the Rio de la Plata. Here is the location of one of the greatest fissure lava flows in time and space on the face of the earth. (Baker, 1923). Black basalt beds, similar to the Dekkan flow of peninsular India, range from 30 to 1,000 meters in thickness. Heavy jungle cover, thick alluvial débris, and blanketing lava beds thus contribute variously to a perncious mask which makes an appreciably large part of interior Brazil's surface and subsurface development difficult, expensive, and dubiously rewarding.

Since pre-Cambrian time that portion of South America, composed principally of the Brazilian geographical confines, has served as the continental nucleus. All during geological time, then, this (like the other shield areas of the world) has persisted as an emergent, structurally dented, heavily eroded cratonic mass. Made up of igneous and metamorphic rocks, it has been the buttress against which many of the marine sediments deposited in the Andean seaway were overfolded and thrust-faulted at the end of the Cretaceous. A relatively few (within so vast an area) depositional basins existed within the stable shield area at different times. They were sporadically inundated by shallow arms of the sea after Devonian time, although fairly persistently so before then, and filled alternately and subsequently with terrestrial sediments. These intercratonic basins represent erosional and structural depressions—usually between topographic highs or near-surface occurrences of the crystalline basement.

The principal marine depositional sites in Brazil (see Fig. I) are linked with five general paleogeographic and tectonic trends: the NW-SE Andean seaway, the E-W Amazon trough, the NE-SW Maranhao-Parnaiba embayment, the Northeastern Coastal province, and the NE-SW Paraña basin.

The Andean seaway includes the Acre piedmont folds on the Peruvian and Bolivian frontiers with Brazil. A tertiary cover conceals Cretaceous beds of the Andean system which outcrop along the border and extend northwesterly into the Ganzo Azul and Maquia producing areas of Peru. The Peruvian Amazon basin, known as the Montaña, includes the basins of the tributary

This map of Brazil shows: (1) South American countries which border Brazil (subdued by shading); (2) names and limits of Brazilian states and territories; (3) principal cities (about 12)which will serve to indicate population density; (4) principal rivers.



rivers Marañon and Ucayalí, and is apparently the easternmost expression of the Andean seaway during Mesozoic time. According to Rassmuss (1957), oil has been encountered only in the Cretaceous—although lower Jurassic limestones (Exposed in the Rio Huallaga section) contain bitumen and are associated with oil seepages. Paleozoics, represented by nonpetroliferous Permo-Carboniferous limestones and Devonian shales (productive in Bolivia and in the Brazilian Amazon extension), are reported as constituting the underlying beds. According to Rassmuss, "no large, deep sedimentary basin has been proved in the Montaña, and several of the few wildcats have struck basement at moderate depth, considering the thickness of the Tertiary continental deposits on top." Despite the fact that 15 oil companies have concessions and are currently developing the Peruvian Amazon basin portion of the Andean seaway, exploration is progressing at a slow rate due to the inaccessibility of the dense jungle area. These same conditions prevail, of course, across the border in Brazil. Because of the nationalistic attitude of the Brazilian government, it will probably be a long time before the Acre and the upper Amazon regions will be drilled.

The Amazon trough follows the course of the river, which lies mainly north of the geosynclinal axis. Apparently canoe-shaped in subsurface outline, the geosyncline plunges easterly from the Peruvian Montaña, and westerly from a high buried ridge at approximately longitude 53° W, coming toward its deepest contact (approximately 14,000 ft) with basement at about longitude 59° W, the site of the Nova Olinda field discovery. Belts of Paleozoic outcrops line both the north and south flanks, resting on crystalline complex and underlying a thick Tertiary-Quaternary cover. Dips are gradual—approximately 2 ft per hundred—but vary at depth where flat anticlinal flexures break the regional geosynclinal attitudes. A generalized cross-section is shown at longitude 55° W, where the approximate width is 200 miles (see Fig.II). Toward its westerly extremity, the outcrop belt of marine sediments and even a good portion of the shield area, both to the north and south, are covered by thick Tertiary alluvium. Sediments here are reported thickest, some 6,000 ft to 8,000 ft according to Taylor (1952), along a swath encompassed between parallels 3° S and 6° S. To the east, the Amazon trough extends into the Marajo graben and deltaic area—probably the deepest sedimentary basin in Brazil—unproductive although with oil shows reported in tests. The paleogeography of the Amazon trough (Weeks, 1947) shows a Mediterranean connection with the Andean seaway interrupted at the close of the Devonian. From then on the Amazon trough was invaded only from the Atlantic side—possibly for a brief period during Permo-Carboniferous (oscillating conditions) and then not again until the Tertiary (intermittently). The Pliocene, for example, is represented by a marine facies only in the eastern extremity of the geosyncline. A possibility exists for the presence of some marine Cretaceous underneath the Tertiary-Quarternary cover of the alluvium-filled Marajo down-faulted block.

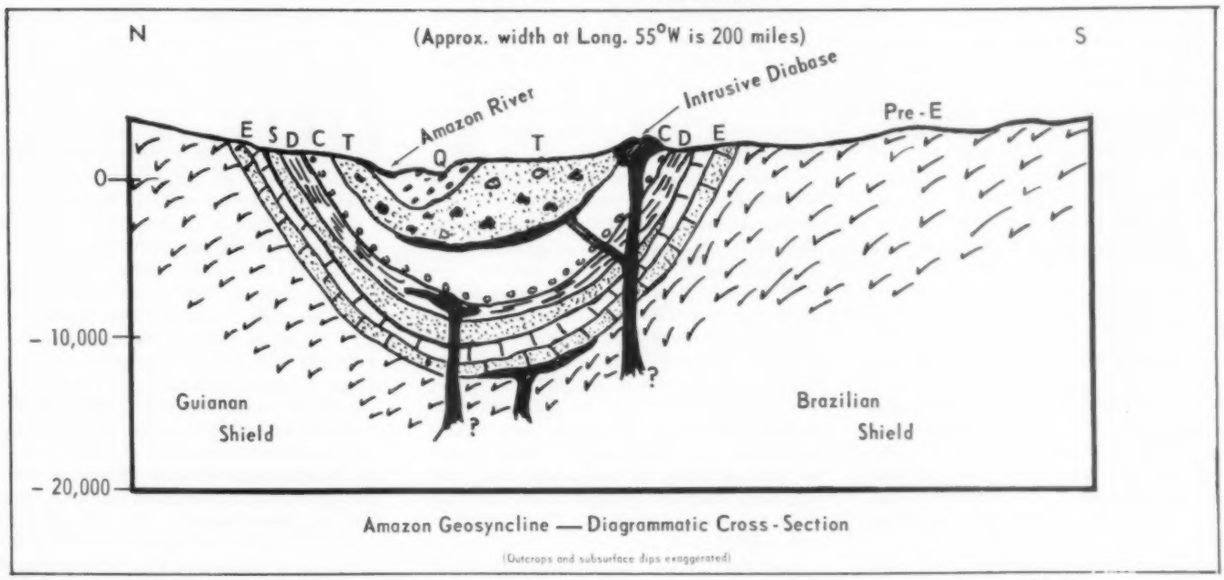
The Maranhao-Parnaiba embayment is made up mainly of the states of Maranhao and northern Goiaz and Piaui, drained by the Parnaiba River; however, an arm of it (not shown on Fig. I) extends southerly beyond a constriction of crystalline complex into northern Minas Gerais and western Bahia. This extension includes the local Rio São Francisco and Rio Salitre basins, which presumably received marine sediments when fingers of the main basin to the north spilled over into these areas during pre-Devonian time. A Silurian, or earlier, connection with the Paraña basin is also likely. The Maranhao-Parnaib basin is a separate embayment, although it contains a similar stratigraphic sequence of shallow-water marine Paleozoics as in the Amazon trough—indicating a possible interconnection during this time and, again, but only in the northern half, during the Tertiary. Some Triassic and Cretaceous are also present, but have been reported (Jenks, 1956) completely nonmarine. As in the Amazon trough, intrusive diabase masses of appreciable extent have been drilled; here they have been found also in several localities as surface expressions. Test wells have disclosed a deepening of the basin westward and northward—with regional dips generally very low. An initial deep test, Caroline No. 1, drilled on a surface anticline in the southwestern part of the basin, reached the crystalline complex at 3,925 ft. A recent coastal test, due east of São Luiz, reached the Devonian at 9,700 ft. Oil shales and oil-gas shows have been reported in basal Devonian; but, despite several tests, there has been no production to date.

The Northeastern Coastal province includes a shore-line strip of land and continental platform, extending from the Ceará-Rio Grande do Norte re-entrant to the northern portion of the state of Espirito Santo. The most important of these areas, of course, is the Reconcavo basin—occupying Bahia de Todos los Santos and extending inland northeasterly paralleling the coast some 70 miles, where the northern limits of the Reconcavo South graben are marked by a buried pre-Cambrian ridge. This is the site of the first commercially productive oil well in Brazil, establishing the Lobato-Joanes oil field (1939) north of the city of Salvador and a few hundred feet off the eastern fault scarp. A large part of the drilling operations [Petroleo Brasiliero SA (Petrobras)] is still concentrated in this area. Several new gas and oil discoveries have been made inland; and offshore extensions of the two principal fields, Dom Joao and Candeias, are currently the trend. Within the narrow confines of the Bahia block, sharply down-faulted into basement, six oil fields are at present producing the brunt of Brazil's petroleum from Cretaceous sediments. Drilling depths to pay vary considerably—from under 1,500 ft to over 9,000 ft—dependent on the presence of local horsts (narrow upthrown wedges) and the magnitude of drag folding. The amount of production is further determined by the degree of porosity and lenticularity of the fine-grained sands, and by the wax content and other crude-oil characteristics. With the possible exception of the northern Espirito Santo area, the Northeastern Coastal province is, from known data, the only locale (other than the Acre-Andean region) where marine Cretaceous occurs. These sediments were laid down for the fist time in the Albian (Weeks, 1947) continuing into upper Cretaceous and Paleocene. An underlying section of red beds of unknown age rests unconformably on pre-Cambrian. A thin clastic series of Tertiary sediments completes the section. In the Espirito Santo area, Miocene fossiliferous beds have been reported. A recent test in the Sergipe-Alagoas basin, close to the mouth of Rio São Francisco, encountered reported commercial production. Several deep tests in this area had disclosed only gas-oil shows. Shows have also been reported in the Cretaceous salient in the states of Rio Grande do Norte and Ceará. Transgressive marine Cretaceous (phosphate-bearing) (Kegel, 1955) has been penetrated in shallow bore holes in Recife—although no indications of oil and gas have been obtained.

The Paraña basin is the large depositional area in southern Brazil extending into Paraguay, Argentina, and Uruguay. Its exact configuration and limits have never been fully mapped. Generally, it embraces a high basaltic plateau area drained by the Paraña and Uruguay River systems, and it includes all of the states of São Paulo, Paraña, Santa Catarina, Dio Grande do Sul except for their eastern crystalline complex limits. The basin also includes the Araguaia synclinal area in southern Mato Grosso and Goiaz, where the stratigraphy described by de Almeida (1954) discloses the Chapada series (lower Devonian) resting on pre-Cambrian, absence of Carboniferous, and generally more oscillation of Paleozoic seas than in the main basin to the south.

Marine invasion of the Paraña basin from the direction of the Andean geosyncline appears to have been fairly persistent until the end of Devonian time. During Permo-Carboniferous, climatic and sedimentation fluctuations produced a series of mixed brackish and continental facies—including extensive lignite beds and glacial sediments ("Gondwana" series) along the eastern margins of the basin in the states of Santa Catarina and Rio Grande do Sul (Putzer, 1955). Especially well developed below the basalt escarpment in Rio Grande do Sul are east-west belts (curving south beyond Santa Maria into Uruguay) of Botucatú cross-bedded, eolian sandstones and Sta. Maria coarse, mesosaur-bearing clastics (Couto, 1940) of upper Triassic age, unconformably overlying the lower Permian Passa Dois and the upper Pennsylvanian Palermo, Rio Bonito, and Itarare series, which in turn overlie basement rocks directly (Machado, 1956).

BRAZIL'S OIL POTENTIAL



Amazon Geosyncline — Diagrammatic Cross-Section

(Outcrops and subsurface dips exaggerated)

SYMBOL	AGE	LITHOLOGY	REMARKS
Q	Quaternary	Alluvial sands, clays, silts, gravels, and organic debris.	Poorly consolidated, irregular thickness.
T	Tertiary	Includes Pliocene. Pebas formation grading westerly into brackish facies.	Little marine in Eocene; fine-grained sands, and shales.
C	Pennsylvanian (middle?)	Some marine limestone—Itaituba formation; evaporites and basal sandstone, some diabase intrusives.	Appreciable unconformities; 5,900-ft reported drilled in Amazon.
D	Devonian (lower and middle?)	All marine: Ereré black shale; Curuá shale and sandstone; Maecurú quartzitic sandstone, with diabase intrusives. (Oil @ ±9,000).	Oil source and reservoir beds; 1,600-ft thickness reported drilled; only small section productive.
S	Silurian (lower?)	Marine Trombetas formation; sandstone and shale not too well differentiated; low dipping.	Outcrops only on north side of the river; cut-out by erosion or overlaps on south flank; very irregular.
E	Cambrian and Cambro-Ordovician (?)	Marine sediments poorly differentiated in most places; discordant on basement complex; diabase sheets near contact. Hard, indurated, metamorphosed slatey shales, quartzitic sandstone, and marbleized limestone.	
Pre-E	Mainly Archaen	Mainly basal crystalline complex with intrusive granites.	Primordial rock, among world's oldest.

Exposures of lower Paleozoics, irregularly in contact with pre-Cambrian, are available only in south-central Rio Grande do Sul in the vicinity of Bagé. A similar belt of Triassic, Permo-Carboniferous, and older sediments parallels the coast and runs northerly through Santa Catarina, Paraña, and into western São Paulo. Stratigraphic thicknesses in all cases vary considerably throughout the basin—dependent mainly on degree of overlap on basement and thickness of the voluminous fissure basalt cover. This latter is probably late-most Triassic in age, and occurs in several flow stages. Formational dips are regionally toward the west, and very low (Almeida, 1954).

Three recent deep tests by Petrobras in north-central Paraña, close to the São Paulo border, have encountered slight shows in the Devonian at depths varying between 6,644 ft and 9,161 ft. Other tests have variously announced weak gas-oil shows in Permo-Carboniferous glacial and lignitic sediments at much shallower depths, but these can pretty well be discounted. In the southwestern frontier of the state of São Paulo, tight, nonmarine, oil-skinned sandstones have been known for many years. Methods have been discussed for the extraction of the inspissated oil with which the sandstones are partly saturated, but as yet nothing has been done on a commercial scale. Adjudged as probably Triassic by their relative position in the section, these sands served as reservoir beds for Devonian (?) source oil. They represent, thus, an exhumed oil field long ago uncovered by nature. In the southernmost portion of the Paraña basin, nine test wells drilled in 1956 for the Uruguayan government were dry.

The regional sedimentation sites just described represent only about one-third of Brazil's total surface area. One, the Paraña basin, is more than 60% covered by thick lava extrusives. None of the five general paleogeographic entities gives much promise of providing thick marine sections —at least as compared stratigraphically to the prolifically oil-producing areas of the world. Venezuela, the Persian Gulf (Kerr, 1952), and the Gulf Coast (Nigra, 1951), for instance, have Tertiary and Mesozoic sections measuring in tens of thousands of feet. In the subsurface, a widely extensive occurrence of voluminous diabase intrusives has been encountered in the Paraña and Maranhao basins, as well as in the Amazon trough where Petrobras recently drilled a mass 1,312 ft thick in one of its deep tests. Marine Jurassic is totally absent in all Brazil. Marine Cretaceous (Nigra, 1952), which has accounted for so much of the world's total hydrocarbons, has been found only in the narrow Northeastern Coastal belt and in the small Acre area in the extreme western part of the country. Marine Tertiary is spotty, both geographically and stratigraphically, and has yielded nothing in the way of gas-oil shows even where present. Pre-Devonian horizons are found in outcrop and subsurface to be generally metamorphosed, and usually they are poorly differentiated. Appreciable unconformities mark the entire Brazalian sedimentary section. Thus far, only the Devonian in central Amazona and the Cretaceous in Bahia-Sergipe have proved commercial.

In addition to the general adversity of Brazilian geological conditions for the finding and production of petroleum, other elements enter to make faster and more rewarding discovery difficult. There exists in the country an appreciable dearth of maps and publications containing revised geologic, topographical, soil, cadastral, and geodetic information. An old, generalized areal geology map with a 1942 date (Oliviera, 1943) prepared by the outmoded Ministry of Agriculture's National Department of Mineral Production, is the best available to Brazilian universities. Petrobras has prepared a few detailed geologic maps in those parts of the basin areas where its contracted field parties have obtained geophysical and outcrop information; but these maps are jealously guarded, and it is strictly a "no dope" situation. Considering that Petrobras has the exclusive right "to explore for and develop all petroleum reserves in Brazil," one wonders what competition a nationalized governmental monopoly has to fear, and why it is so secretive. Up-to-date data on some areas (see references), which have been studied and published by university researchers, are fortunately available. This, though, represents, a drop in the bucket in ratio to the overall picture.

At the beginning of the last academic year on April 2, 1957, a program was inaugurated for the training of professional

geologists in four major universities (federal) in Brazil. There had been no prior provision for training geologists in Brazil other than an indirect approach through the curricula of mining and civil engineers. This provided, at best, an inadequate subject coverage and treatment. The Conselho Nacional do Petroleo finally awoke to the realization of the country's shortage of trained geologists (CAPES, 1955). Through CAPES (Campaha Nacional de Aperfeiçoamento de Pessoal de Nivél Superior) and the Ministry of Education, they managed to secure an appropriation for the implementation of an integrated geological course of study at the Federal universities of Rio Grande do Sul, São Paulo, Ouro Preto, and Recife. Two years ago, Petrobras, acting on its own initiative—had set up an accelerated two-year program for the transmutation of any available graduate Brabilian scientist or engineer into petroleum geologists and petroleum engineers. This is still being carried on at the University of Bahia, utilizing mainly foreign (including six American) professors at a reported salary of $10,000 per year. There are now something like 92 total students undergoing professional training in geology in Brazil. This is a quantity well exceeding the number of active Brazilian geologists in the country. If all goes well with these training programs, in four years the pressing need for geologists will have begun to be met—although, it will be at least 8 to 10 years before sufficient experienced geologists will become available to meet the current national demand. Needs at present are being met in part by an active recruiting campaign for foreign geologists and petroleum technicians, many of whom have been induced to go to Brazil from the USA and Canada. In addition to geologists and petroleum engineers, an acute shortage of production foremen, tool-pushers, drillers, well-pullers, pipeline personnel, and mechanics exists in Brazil.

Brazil's National Petroleum Council, the rule-maker for the country's oil industry, was created by federal decree in 1938. Patterned after USA lines, it assumed responsibility for petroleum exploration and development activities, but was subsequently superseded in these functions by the creation of Petroleo Brasiliero SA (Petrobras), a quasi-autonomous national oil company. The idea was to accelerate oil development—still retaining the nationalistic concept—by forming a politically independent organization which, theoretically, could operate with the efficiency of private enterprise. It is the opinion of a representative part of the Brazilian press and of many thinking Brazilian professionals that bureaucratic "snafu" has been intensified rather than diminished by this arrangement. A frantic $30 million drive to find commercial oil in the Amazonas during 1958 has been started by Petrobras. This is, of course, "peanuts" for so vast an area, according to internationally operating oil-company standards, and may well mark the all-out make-it-or-bust swan song of Petroleo Brasiliero, Sociedade Anonima. Recently, public outcry—increasing above the chauvinistic clamor of the politicos—has won President Juscelino Kubitschek's support. Last October, he issued an executive decree which unequivocally assigns control "over imports, exports, refining, and transportation and distribution of petroleum derivatives" to the Conselho Nacional do Petroleo. In no uncertain terms, this makes it known that Petrobras is not the one to select oil-marketing companies or methods for oil distribution. Bolivia's recent decision not to admit a foreign government monopoly (Petrobras) but, instead, to allow private Brazilian capital into its revitalized oil-concession granting program, has opened the eyes of many. These are all forward steps in extinguishing the self-consuming flames of Brazilian nationalism which has prevented realistic development of what oil resources the country has, and has been a jarring setback "in the struggle of the workers and middle class toward a better life."

Summary: Brazil, larger than the United States in area, represents the main geologic nucleus of the South American continent. More than two-thirds of the country's surface is made up of denudated ancient rocks, found abundantly mineralized in many places. Where not exposed, this crystalline complex is frequently encountered in the form of buried highs or ridges with a thin detrital cover. Not so fortunate, from the viewpoint of petroleum source and reservoir materials, Brazil has only about one-third of its surface composed of sedimentary rocks accumulated in relatively shallow depositional basins and morphostructural depressions—the largest, but not necessarily deepest, expression being the Amazon trough. Much of the stratigraphic section is made up of nonmarine fluviatile materials and further discountable, thereby, as probably oil-bearing.

Marine Jurassic formations are unknown anywhere in Brazil. There is also a noteworthy paucity of globally productive Cretaceous and Tertiary beds. The only extensively marine horizons are lower Paleozoics, but of these only the Devonian has been found petroliferous. In many instances, moreover, areas having structures and substrata deemed favorable are intruded by extensive diabase sheets and covered over by impenetrable jungle growth or great thicknesses of fissure lava. This makes exploration largely infeasible, and drilling costs almost prohibitive. Sole commercial oil production (Cretaceous) comes from the small, paleotectonically unique Reconcavo graben in the state of Bahia—although token recoveries are now being made from deep, expensive tests in Amazonas.

Socio-economic factor also require consideration. Brazil is currently engulfed in a wave of nationalism which may hinder its full, logical development for many years to come. A program for the training of professional geologists has been organized only in the past few months. It will be at least 10 years, though, before the country can augment the ranks of its experienced geologists, who unbelievably number only some 50 at present. Transportation and communication in the largely unpopulated interior are poor. Adequate maps are lacking. Today, Brazil imports about 90% of its domestic requirements of oil. It thus uses up a good part of its dollar credit ($268 million on oil imports in 1956) which could be better spent on railroads and highways.

Though Brazil can never hope to rank among the leading oil-producing nations of the world—even with optimum conditions—it may hope to become nearly self-sufficient in crude-oil production within the next 10 to 20 years. Present demand is ±300,000 b/d. There is always that possibility because, geographically huge as the country is, there are still many unlocalized sites to be explored by the drill. This certainly would be infinitely expedited if the Brazilian government adopted a realistic oil-concession program similar to that of its peripheral neighbors . . . Venezuela, Colombia, Peru, and recently Bolivia. At the present single-shot snail's pace rate of development of its oil potential, Brazil may just as well start thinking in terms of atomic reactors as a more immediately realizable source of energy. END

REFERENCES

ALMEIDA, F. F. M. DE (1954), "Geologia do Centro-Leste Mato-Grossense," Dep. Nac. da Prod. Miner., Div. de Geol. e Miner., Bol. no. 150, Rio de Janeiro.

BAKER, C. L. (1923), "The lava field of the Parana basin, South America," Jour. Geol., vol. 31, no. 1, Chicago.

CAPES (1955), "Formação de Engenheiros e Arquitetos," Bol. no. 31, Junho, Rio de Janeiro.

CLARK, E. W. (1957), "1956 Developments in Foreign Petroleum Fields: South America and Caribbean," Bull. Amer. Assoc. Petrol. Geol., vol. 41, no. 7, Tulsa.

COUTO, C. DE P. (1940), "Repteis Fosseis do Brasil," Anais do III Congresso Sul-Riograndense de Hist. e Geogr., Porto Alegre.

JENKS, W. F. (1956), *Handbook of So. American Geology*, Geol. Soc. Amer. Memoir 65, June, New York.

JOHNSTON, W. D., JR. (1954), "A foreign geologist looks at Brazil's mineral future," Anais da Acad. Bras. de Cien., vol. 26, no. 1, Rio de Janeiro.

KERR, R. C. & NIGRA, J. O. (1952), "Petroleum developments in the Middle East and adjacent countries in 1951," Bull. Amer. Assoc. Petrol. Geol., vol. 36, no. 7, Tulsa.

LINK, W. K. (1952), "Significance of oil and gas seeps in world oil exploration," Bull. Amer. Assoc. Petrol. Geol., vol. 36, no. 8.

MACHADO, E. R. & CASTANHO, O. S. (1957), "Pesquisa de carvão mineral na faixa sedimentar do Rio Grande do Sul," Dep. Aut. de Carvão Min., Rep. Prof., Porto Alegre.

NIGRA, J. O. (1957), "Geological considerations pertinent to the economic development of Iraq," Proc. XX Int'l. Geol. Congress, Section 15, Mexico City.

NIGRA, J. O. (1952), "Cretaceous stratigraphy of the Tampico embayment," Abstract, Bull. Geol. Soc. Amer., vol. 63, no. 12, pt. 2.

NIGRA, J. O. (1951), "El Cretácico Medio de México," Bol. Asoc. Mex. de Geol. Petrol., vol. III, nos. 3-4, Mexico City.

OLIVIERA, A. I. & LEONARDOS, O. H. (1943), *Geologia de Brasil*, 2nd. edition, Rio de Janeiro.

PUTZER, H. (1955), "Geologia de Fôlha de Tubarão," Dep. Nac. da Prod. Miner., Div. de Fomento da Prod. Miner., Bol. no. 96, Rio de Janeiro.

RAMBO, P. B. (1956), *A Fisionomia do Rio Grande do Sul*, Livraria Selbach, Porto Alegre.

RASSMUSS, J. E. (1957), "Oil discoveries in the Amazon basin," WORLD PETROLEUM, vol. 28, no. 11, New York.

WEEKS, L. G. (1947), "Paleogeography of South America," Bull. Amer. Assoc. Petrol. Geol., vol. 31, no. 7, Tulsa.

OIL FACES EAST

Imports must rise as oil's center of gravity shifts away from the USA.

THE transformation of the petroleum industry in the past two decades—marked by the shift in oil's center of gravity from the United States to the Middle East—is the subject of a recent study by Leonard M. Fanning, authority and writer on world oil policies, and published by Gulf Oil Corp., Pittsburgh. Though published by Gulf, author's opinions are his own.

The impact of this transformation upon the American oil industry and upon Free World security is emphasized by Mr. Fanning—who concludes that our nation must rely more heavily on oil imports in the future, despite the temporary oversupply in this country. It is not in the public interest to shut off oil imports, he says.

Fortunate for the defense of our country and the rest of the Free World was the initiative of private American oil interests—with the blessing of our government—who pioneered in the search for oil reserves abroad after World War I, says Mr. Fanning. The persistent and continuing efforts of these American enterprisers beyond our own shores since then have paid off by securing for us an adequate oil supply, and by preventing what might have proved disastrous for our country had not our own nationals retained control of these resources —particularly vis-à-vis the Soviet economic offensive.

The high points of the great transformation in world oil during the past two decades—with implications vital to the United States and the Free World—are outlined in the Fanning report as follows:

"Twenty years ago if you pointed off the "center of gravity" of world oil production on the map, it would be in the United States. Today it has left our continent. In 1935, the United States produced 68% of the Free World's oil; in 1957, only 47%.

"More striking still, the 'center of gravity' of world oil reserves has moved from this continent plumb into the Middle East. United States reserves in 1938 made up 59% of Free World reserves; now they are only 14%. The Middle East alone accounts for 71% of Free World reserves.

"The United States had 72% of the total Free World crude-oil refining capacity in 1935; today it has 52%, while Western Europe has increased its refining capacity from 6% to 16%.

"There has been a significant shift in the center of gravity of world petroleum consumption. We ourselves consumed 68% of Free World oil in 1945; in 1957, 54%.

"Yet our increase in consumption between these years has been enormous—at the rate of 79%. But Europe's consumption has gone up 292%. The consumption of the entire Free World outside the United States has risen 219%."

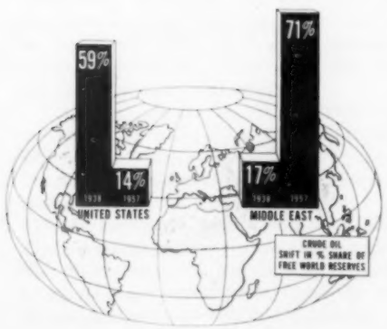
The compelling reasons for American oil companies to seek and develop oil resources abroad have been our diminishing reserves and increased costs of finding oil at home. To supply the needs of two wars and a "battle-devastated Europe" would have been too great a strain on the domestic industry, believes Mr. Fanning. Because of our oil investments abroad, we have increased our ownership in reserves abroad to 57% today—from 35% in 1938. Thanks to American enterprise, we have largely restored our ownership in reserves, although today that ownership is substantially located in other countries.

Mr. Fanning also emphasizes the position of our government with respect to ownership of oil abroad. A 1944 State Department memorandum stated, in effect, that the public interest of the United States requires maximum conservation of domestic and nearby reserves and large-scale expansion of holdings in oil reserves abroad by USA nationals.

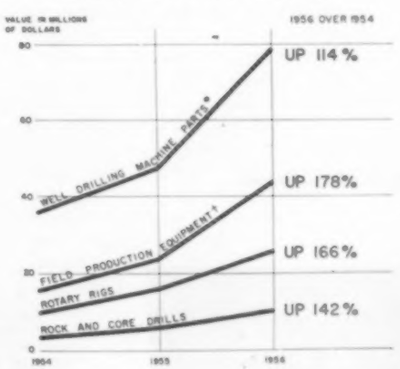
No longer is world oil a field merely for a handful of American international giants, the study emphasizes. Today about 190 American companies are active in oil exploration and production in 91 countries outside the USA—and the number is growing. This compares with 28 American oil companies active abroad when World War II ended. These 190 companies, so-called, comprise a complete cross-section of the American oil-producing industry. "Never was there greater need for diversification of sources," says Mr. Fanning.

The factual report, titled *The Shift of World Petroleum Power Away from the United States*, may be obtained on request to the Gulf Oil Corp. It is well documented with tables and charts.

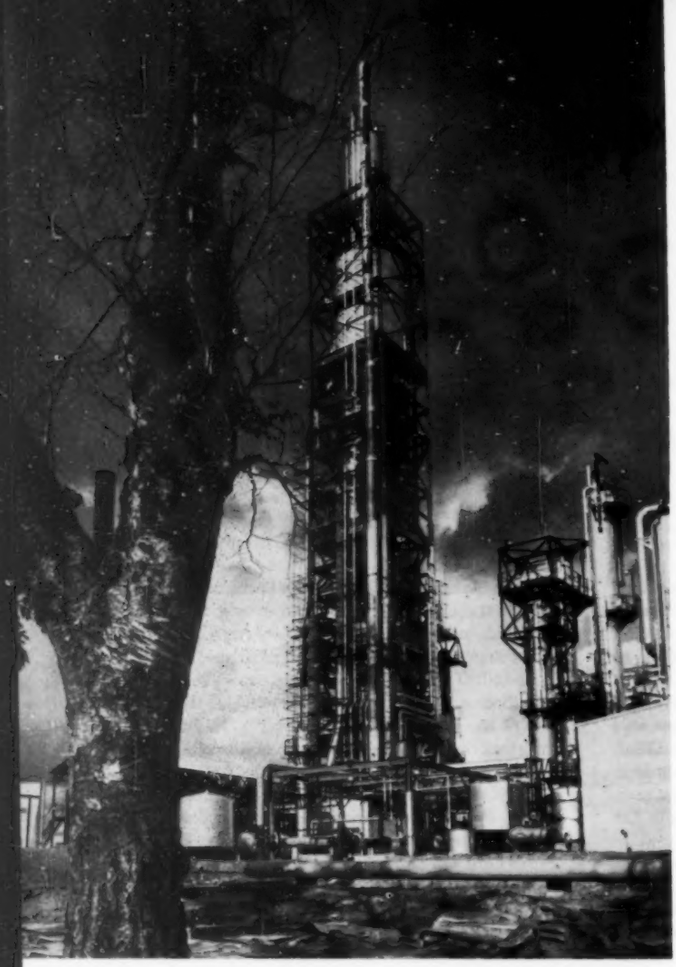
Author Fanning has written numerous books and articles in his more than 35 years as an observer and student of international oil. He is the editor of WORLD PETROLEUM POLICIES, published at 604 Fifth Ave., New York 20, N. Y.—a new and vital service for executives, speakers, legislators, public-relations counselors, lawyers, and librarians. END



USA exports of oil-field equipment



* Crown and traveling blocks, cementing equipment, coring equipment, derricks and derrick substructures, etc.
† Casting and tubing, acidizing equipment, christmas trees, etc.
SOURCE: USA Department of Commerce. Because of reporting variations and sampling techniques, the chart does not show precisely the dollar value of equipment actually exported each year. But it accurately reflects the rising trends in the export of principal oil-field items. Taken from *The Shift of World Petroleum Power Away from the United States*, a study by Leonard M. Fanning, published by Gulf Oil Corp.



Socony Mobil Thermofor catalytic cracking unit has a fresh feed charge of 6,000 b/sd. Heart of the refinery, the unit helps Neste Oy produce high-octane gasoline.

Finland's first refinery

Neste Oy refinery is first in Europe with all electronic controls for which uninterrupted operation is assured by emergency auxiliary generator.

by Carl H. Gamer

Carl H. Gamer, manager of process engineering for Lummus Engineering NV, European subsidiary of Lummus Co., is an alumnus of the Polytechnic Institute of Brooklyn, from which he received his bachelor and master's degrees in chemical engineering. He joined Lummus as a process engineer in 1938 and, after some experience as an operating engineer and process coordinator, was made head of the proposal department in 1950, and manager of process engineering in 1952. In 1954, he was assigned to The Hague, Netherlands, as part of a team setting up a new engineering office there.

Mr. Gamer is an adjunct professor of chemical engineering in the graduate school of the Polytechnic Institute of Brooklyn, and has given courses relating to petroleum and petrochemicals there since 1945.

With the placing in operation of Finland's first complete refinery, the new Neste Oy installation marks the successful culmination of more than two years' effort and cooperation on a truly international scale.

Europe's first refinery to have a fully electronic control system is located at Naantali, in the southwestern corner of Finland.

Neste Oy is designed to handle 18,500 bbl per stream-day of a combination of Middle East and Russian crude, or 19,200 b/sd of Russian crude alone.

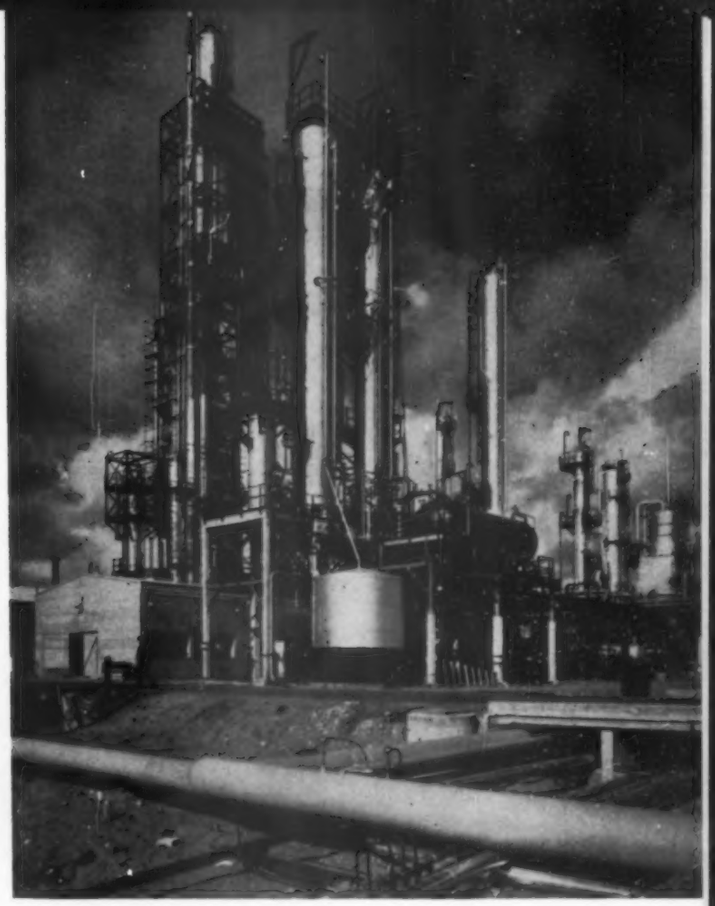
The refinery construction was completed in July 1957. Within six weeks after startup, the refinery was up to capacity—producing specification products—and shortly after that it was operating at up to 115% of capacity.

Before its entry into the refining business, Neste Oy was engaged in bulk distribution of petroleum products, and conceived the idea, in the international interest of the country, to provide additional industrial activities.

To supply technical knowledge and general assistance, Neste Oy engaged The Lummus Co. and its Dutch and French affiliates, Lummus Nederland NV and Ste. Française des Techniques Lummus. These Lummus offices worked in cooperation with Socony Mobile Oil Co., The Atlantic Refining Co., and California Research Corp.—which supplied licensed processes and assisted in the ultimate training of Neste personnel. The Lummus companies performed the process design and engineering—including inspection and expediting of materials for the complete refinery—and provided the skilled personnel required to assist in supervision of construction. Lummus also rendered assistance in the training of Neste Oy personnel by the use of a training school where these people received instruction, followed by field experience—and, not least, by training in the refineries of the cooperating oil companies previously mentioned.

It was found desirable to have the capital investment assisted by a financial arrangement; and, because of the interconnected relationship of market for equipment and financing, Lummus assisted Neste through its European subsidiaries in the selection of the companies finally chosen for the supply of financing and materials.

The prime contractor for materials and erection became the French Compagnie des Fives-Lille, which supplied most of the materials and equipment except piping materials—which were furnished by the company Mannesmann-Seiffert Rohrbau GmbH. These companies also carried out the erection of the material they supplied, under Lummus supervision; while Neste Oy performed all the civil work for the refinery.



Several of Neste Oy's process units: From left to right are Socony Mobil's Thermofor catalytic cracking unit; Calif. Research Corp.'s catalytic polymerization unit; vapor-recovery unit; and atmospheric distillation unit. (Note: All photos in this article by courtesy of The Lummus Co.)

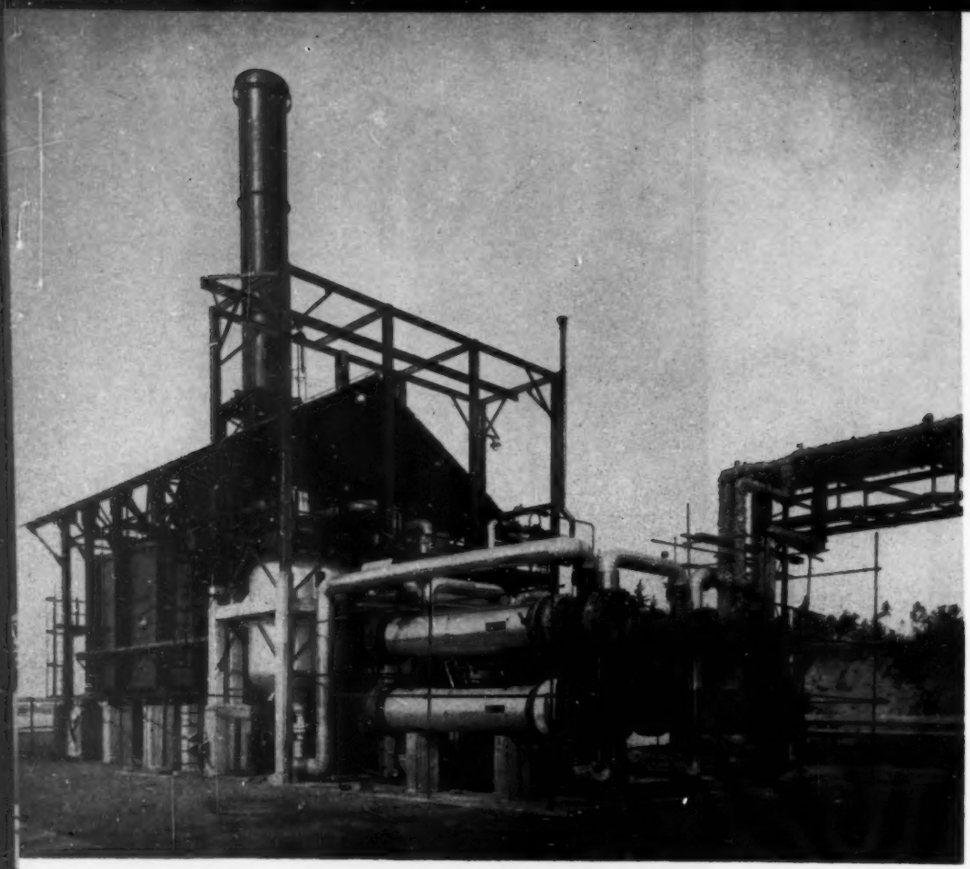
Although most of the equipment came from France and Germany, a small amount was purchased in England, Holland, and Italy because of advantages in price or delivery for particular items. Certain specialty items, such as electronic instruments, were imported from the United States, since they were not available from European sources in sufficient time. These were, however, kept to a minimum to conserve scarce dollars and to maximize the use of European currencies.

Crude-oil purchases are likewise of an international character—with about 50% of the refinery's requirements being met by Russion Tuimaza crude and 50% by Mid-East crude furnished by Shell and Gulf. These two companies receive refined products in the proportion of the crude they supply, while the balance is sold to other companies distributing in Finland. All crude shipments are by tanker, since the refinery's Baltic Sea location is on a port which reinforced tankers—with the assistance of icebreakers—can reach even in the winter, and Neste is gradually increasing its tanker fleet. Gasoline output of the plant is sufficient to supply about 90% of Finland's current needs. There is a surplus of LPG, which is now being exported by tanker to Denmark and by railway to Sweden.

Civil work for the refinery was started in October 1955, and carried out through the winter. Despite the difficult supply situation existing in Europe and the hardships of construction during the two Finnish winters, the entire project was completed less than 24 months from the date when procurement areas had first been definitely established.

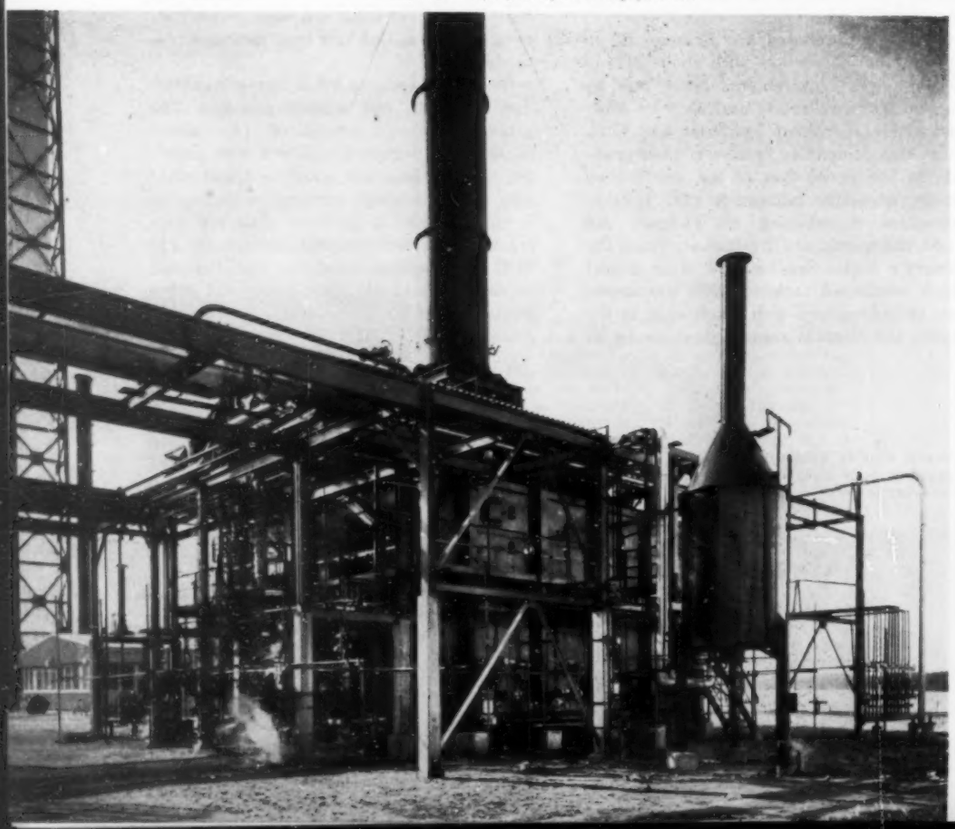
Neste Oy produces a full line of gasoline, fuel oil, LPG, and asphalt products. The processing scheme consists of: (1) electric desalting and crude distillation with multiple side streams and gasoline debutanization; (2) two-stage vacuum reduction of reduced crude to produce distillate cat-cracker feed and penetration asphalt; (3) TCC mixed-phase catalytic cracking and vapor recovery; (4) phosphoric-acid polymerization of C_3-C_4 unsaturates and separation of LPG; (5) catalytic reforming of

General view of Neste Oy refinery: Refinery site is in the midst of rugged, natural surroundings on Naantali's green peninsula in the southwestern corner of Finland.



Catformer heater reactors and exchangers: Design capacity of this unit is 3,400 b/sd. Heater is floor gas-fired, designed to meet high-pressure and temperature service conditions.

This uptake atmospheric and vacuum heater is designed for a capacity of 19,200 b/sd, and fires heavy fuel oil.



straight-run naphtha; (6) gasoline and distillate treating, with deodorization and neutralization of spent caustic; (7) asphalt oxidation for specialty asphalts.

The process units are designed for combination-unit operation, in which the products of one unit are charged to subsequent ones without intermediate cooling or storage—thereby reducing investment and operating costs. Although the units are conventional in design, they incorporate several innovations:

1. First use of the newly developed Atlantic Refining Co. catalytic reforming catalyst AKC-16.
2. First large-scale European TCC unit to use catalyst coolers located externally to the burning kiln.
3. First complete European refinery to utilize an all-electronic control system.

The high degree of integration of the process units made it of paramount importance to provide a system of instrumentation capable of efficient centralized control with complete dependability under the severe conditions of Finnish winters. An electronic system of the DC circuit type was selected as being most favorable for this installation.

With the exception of a few items of secondary importance, all indicating, recording, and control functions are centralized in a single control room located in the middle of the prcoess area—from which good visibility and access are available for the whole area. Multi-point recording and indicating temperature instruments are located on a console desk facing the main panel, while all others are on the main panel. By using miniature-type instruments and a newly developed technique of graphic panel arrangement, all process units are clearly presented without crowding on an 18-meter-long panel.

Aside from this cost advantage, the principal factors which favored the use of electronics for this project were the expectation of:

1. Faster onstream time due to elimination of the countless leaks and plugged air lines normally encountered in the initial break-in period.
2. Avoidance of difficulties due to freezing weather.
3. Fast and accurate control, together with precise setting of alarms and interlocks without drifting or hysteresis.
4. Flexibility for easy addition or subtraction of instrument components due to the simple series circuit of the DC system.
5. Ease of installation due to possibility of "common" wiring without special precautions regarding cable shielding.

Although the DC system is relatively insensitive to electric-supply voltage variations, complete interruption of power of even a fraction of a second, such as commonly occurs in modern lightning-protected main-line systems, causes the instruments to cease to function. While the instruments immediately pick up on resumption of power, their zeroing-out during the interruption actuates alarms and

safety interlocks working from the zero position. Since these interlocks are generally irreversible and require manual resetting, this results in needless upset of the process and loss of time. Consequently, it is of interest to provide for uninterrupted power to the instruments at all times.

This is accomplished in the Neste Oy installation by the ingenious use of a dual-drive auxiliary generator for emergency supply of lights and instruments. The generator is normally driven at about 15% capacity by a small electric motor; but, on main-line power failure and stoppage of the motor, an 85-hp diesel is automatically started and switched in to take the load. An oversized flywheel permits this switch to be made without loss of power and with negligibly low drop in voltage, insufficient to disturb the instruments. Performance of this set has been excellent, and on several occasions has already enabled the refinery to ride through power failures without loss of instrument action.

Actual experience of the entire electronic-instrument system at Neste Oy has been extremely satisfactory; in fact, it has surpassed original expectations. Instruments were put into service with practically no difficulty, and their almost trouble-free performance contributed greatly to smooth startup and operation of the refinery.

One factor which helped considerably in this achievement was the careful pre-operational checkout given the entire instrument system. To augment the knowledge of Neste's instrument staff, a training program was set up which included checking out of all instruments and hookups. In addition to valauble training, this program uncovered and permitted correcting various points which could have been difficult to locate and possibly costly to correct during operation. The further benefits are apparent from the fact that, in less than two months after their first exposure to an operating refinery and to electronic instruments, the Neste instrument group was able to handle all normal trouble-shooting and maintenance without outside help.

Asphalt vacuum and oxidation unit, designed to produce 1,300 b/sd of paving-grade asphalt.

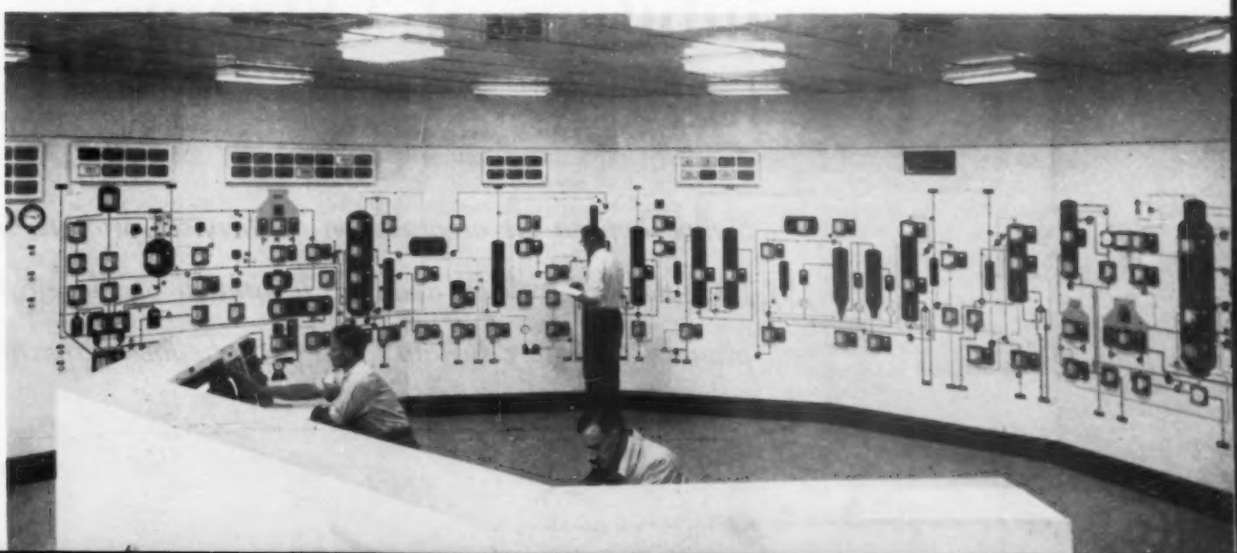
Since the refinery was built on a virgin tract as a "grass-roots" installation, complete auxilitary and offsite facilities had to be provided. These include sea-water pumping stations for cooling and fire use, compressor stations for instrument and plant air and outdoor-type steam boilers complete with feed-water treating. Power is brought in at 110,000 volts and reduced to 35,000 volts and subsequently reduced to 6,000 volts, 380 volts, and 220 volts.

Tankage for approximately 30 days' storage of crude and finishing products and facilities for railroad, truck, and tanker or barge shipment of all products are provided. Also included are facilities for addition and blending of TEL, inhibitors, dyes, deactivators, etc., as required for the various distilled products.

Due to its somewhat remote location, the refinery has its own firehouse and fire-fighting equipment, and its own trained fire-fighting force. For similar reasons, a fairly complete warehouse and workshop are available for maintenance and light fabrication. A modest but well equipped laboratory provides for routine plant control and research, and also houses engineering personnel. Other personnel are officed in a modernly styled administration building, which also contains a dining room and canteen and change house and lockers for workers. And, by no means least, the refinery boasts its own guest house and Finnish Sauna.

The Neste operation and maintenance staffs have proved themselves so adaptable to their work that within six months after startup, by January 15, 1958, they took over complete operation of the refinery. Thus, in only 2½ years' time, has been achieved the goal of having a modern refinery operated entirely by Finns and capable of filling a major part of Finland's demands for high-quality petroleum products. And by no means less important, Neste Oy's new refinery is already giving promise of becoming the center of a new industry on Finland's green peninsula. END

Electronic control room: With exception of a few secondary items, it houses all indicating, recording, and central functions in a single centralized location. Multi-point recording and temperature-indicating instruments are located on a console desk facing the main panel, while all others are on the main panel. By using miniature-type instruments and a newly developed technique of graphic panel arrangement, all process units are clearly represented without crowding on on a 60-ft-long panel. Neste Oy is first complete refinery in Europe to have a fully electronic control system.



Interior of Olympia at a previous industrial exhibit.

Chemical and petroleum engineering exhibition at Olympia

Symposium on the organization of chemical projects, sponsored by Institute of Petroleum and The Institution of Chemical Engineers, planned to feature Britain's first petrochemical exposition

by A. L. Paget

OLYMPIA—the name harks back some 30 centuries to the days of ancient Greece, the cradle of our western civilization and founder of European philosophy and science. Here, in the shadow of the Temple of Zeus, athletes from all the Hellenic states assembled to display their prowess. Londoners like to think the name has been transferred—not unworthily—to the great hall which was opened in the 50th year of the reign of Queen Victoria.

Under its vaulted glass dome, for many years was held the Royal Tournament, where the services showed their paces: the guards in their bear skins marching with machinelike precision, the jolly Jack Tars slinging a dismantled field piece high above a river crossing, and a battery of the Royal Horse Artillery, in their musical ride, galloping at full stretch around the arena amidst a cloud of dust and the thunder of hoofs. Appropriately enough, it was here also that Buffalo Bill, with his daring horsemanship and dazzling gun play, introduced Londoners to the thrills and romance of the Wild West.

In recent years, Olympia has been the chosen site for many of the most important exhibitions which have taken place in London. It is, therefore, altogether fitting that The Chemical and Petroleum Engineering Exhibition should be staged in these great halls. Under the sponsorship of the British Chemical Plant Manufacturers' Assn. and the Council of British Manufacturers of Petroleum Equipment, the organizers have planned this enterprise, to show a power-hungry world the plant and equipment now available to these rapidly expanding industries. During midsummer 1958, from June 18 to 28, therefore, this great international exhibition, the first of its kind ever to be held in Britain, will open its doors to all those whose livelihood and interests lie in the chemical and petroleum industries.

The worldwide appeal of the exhibition dictated that the preliminary announcement should be printed in four languages, and already well over 275 manufacturers have booked stands—with the result that the original accommodation has had to be doubled and now occupies the whole of Olympia's two largest halls and galleries.

The growth of the British chemical and petroleum industries is the direct outcome of the policy of refining crude oil in consumer, rather than in producer, countries. This naturally demanded a vast investment program, and to deal with an expansion of such proportions the British plant and equipment industries have been developed to a remarkable degree. The main purpose of the exhibition is, in fact, to enable visitors to see displayed under one roof concrete evidence of what exhibitor manufacturers have achieved in meeting this challenge to expansion of their programs.

For convenience, exhibitors may roughly be divided into four classes: contractors for complete refineries and chemical works; designers of process plants for the production of heavy chemicals, fertilizers, petrochemicals, coal-tar byproducts, fine chemicals, pharmaceuticals, plastics, paints, varnishes, soap and glycerin; specialists in equipment for exploration, oil-field equipment, and oil-well machinery—including everything from plant for size reduction and separation, distillation, solvent recovery, evaporation, centrifuging, etc., to oil engines, electric generators, and laboratory equipment; finally, fabricators of plant in the more recently developed ferrous and nonferrous metals and alloys, in stoneware, fused silica, plastics, carbon and glass. It will, thus, come as no surprise to learn that the plant, equipment, and ancillary services offered by the various exhibitors will cover nearly a thousand different product classifications.

Not the least important event during the exhibition will be the scientific and technical conference at which authorities will be speaking on a variety of subjects. The Institution of Chemical Engineers, in conjunction with The Institute of Petroleum, will stage a symposium on "The Organization of Chemical Engineering Projects," and papers will be presented at four sessions spread over three days. This symposium will also form part of the 1958 program of the European Federation of Chemical Engineering.

Papers to be presented include the following:

June 24: "The Organization of Chemical Engineering Construction Projects," by Sir Leonard Owen, of the United Kingdom Atomic Energy Authority; and "Design Data and Specifications of Requirements, Including Site Selection," by J. P. Asquith and L. S. Davis, of W. J. Fraser & Co. Ltd.

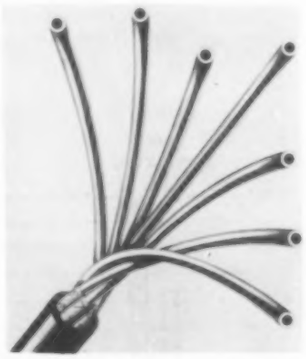
June 25: "Systems of Project Organization," by K. M. Curwen, of Albright & Wilson Ltd. The same subject will be discussed also by R. E. Bywater, of Simon-Carves Ltd. "Functions of the Contractor" will be discussed by W. H. A. Webb and H. H. M. Jones, of A.P.V. Co. Ltd., and also by L. B. Baker, of E. B. Badger & Sons Ltd. "Programming and Progressing Systems, and Meeting Completion Dates" is the subject to be treated by J. O. Dugdale-Bradley, of Shell Chemical Co. Ltd., and also by W. V. M. Kelly, of Power-Gas Corp. Ltd. "Cost Estimating and Control" will be discussed by P. Brett, of Imperial Chemical Industries Ltd.

June 26: "Plant Commissioning" will be discussed by D. W. K. Barker, of British Petroleum Co. Ltd., and by A. F. Cottrell, of Woodall-Duckham Construction Ltd. Also, in the final session, "The Analysis and Future Use of Project Records" will be discussed by S. T. Card, of Distillers Co. Ltd., and by R. Adams, of George Wimpey & Co. Ltd.

A series of films will also be shown to demonstrate graphically, and in considerable detail, the extensive contribution which British chemical and petroleum engineering firms have made to the growth of the industries they serve.

Applications already received, and advance information as to the number of intending visitors, indicate the worldwide interest aroused by this exhibition. Everything, in fact, tends to show that Britain will, in due course, be welcoming the largest international gathering ever assembled of those whose interest lies in chemical and petroleum engineering.

Hereinafter are given the names of some of the firms which will be exhibiting, together with a brief survey of the equipment and services they offer.



Sample of cabled-copper tube for instrumentation, metering, and control—manufactured by British Insulated Callender's Cables Ltd.

British Insulated Callender's Cables Ltd. will be showing almost every type of cable from that required for the heaviest power loads to the lightest plastic-insulated telecommunication cables and wires. An interesting development is the application of cabled copper tube for instrumentation, metering, and control—which was developed some years ago in collaboration with experienced oil-refinery engineers to simplify the installation and maintenance of tube connections between gas-pressure- and liquid-pressure-operated instruments. The required number of individual tubes, each with a numbered tape for identification, is laid up like the cores of an electric cable and sheathed overall with a protective plastic covering. The main advantages are simplified installation, resistance to corrosion and weather, and easy identification.

Newman, Hender & Co. Ltd. will be ex-

(Continued on page 72)

Oil company earnings—

UP—1957

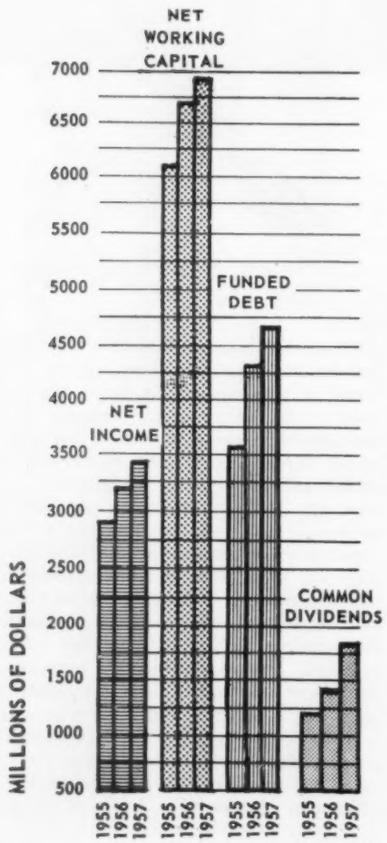
DOWN—1958 (1st QUARTER)

NET income of 43 USA oil companies increased 3.2% in 1957, to $3,345 million. This compares with earnings totaling $3,238 million in 1956. In the previous year earnings had risen 12.3%.

The net income of six Canadian integrated oil companies increased about 10% during the year, to $124.5 million. The increase in Canadian company profits also was less than in 1956—when there had been a rise of 19% over 1955.

Three Latin American companies earned $448 million in 1957, compared with $384 million in 1956 and $333 million in 1955. The rate of rise in earnings in this area was greater last year than the year before.

Two major European companies, British Petroleum and the Royal Dutch-Shell group, earned a total of £264 million in 1957, compared with £232 million in 1956 and £202 million in 1955.



Capital investment programs continued at a high level during the year—with a large portion of the funds being internally generated. Funded and long-term debt of the 43 USA companies rose about $252 million during the year, to $4,646 million. Combined surplus account of the 43 companies—including capital surplus and retained earnings—rose $1,995 million, to $18,083 million. Net working capital increased $272 million during the year, to $6,858 million.

Net capital assets of the 43 USA oil companies during 1957 rose $2,291 million, to $23,774 million.

The trend among Canadian integrated companies was similar to that in the United States. The six majors on which details are given in the accompanying tabulation increased their funded debt $15 million, to $272 million; increased their net capital assets $101 million, to $1,040 million; and surplus $76 million, to $554 million. Only one of the Canadian integrated companies added to its funded debt in 1957.

Only one of the three Latin American companies listed in the tabulation had any funded debt. Sinclair Venezuelan Oil Co. has a debt of $13 million, which was $2 million less than a year earlier. Net capital assets of the three companies increased $236 million in 1957, to $1,164 million; and retained earnings rose $118 million, to $744 million.

Cash-dividend payout in 1957 amounted to about 44% of net earnings.

First-quarter 1958 revenues fell sharply—more than 30% under the same 1957 period. Generally, oil companies ascribed the decline to the aftermath of the Suez Canal crisis last year—which stimulated production to abnormally high levels to meet the European oil shortage, and to the squeeze between crude-oil costs and depressed product prices, as well as to business conditions generally. Improvement is looked for later in the year because of the steps being taken by the domestic industry to correct the imbalance between supply and demand.

As one oil-company president put it: Stocks of refined products are decreasing, with prospects they should be down to manageable levels by the third quarter. At that point, "we can look for some strengthening in oil prices."

FIRST QUARTER NET INCOME 1958

(Thousands of Dollars)

Company	Net Income 1958	Net Income 1957	Per Share of Common 1958	Per Share of Common 1957
Amerada Pet.	$ 5,551	$ 8,746	$ .88	$1.39
Anderson Prichard	659	1,484	.34	.84
Apache Oil Corp.	53	22	.14	.06
Arkansas Fuel Oil Corp.	2,305	2,235	.60	.59
Ashland Oil & Ref.	2,466	4,919	.36	.80
Atlantic Ref.	2,695	14,761	.26	1.61
Barber Oil	—46	33	...	.04
Bishop Oil	27	102	.05	.18
Champlin Oil & Ref.	1,302	3,167	.30	.75
Cities Service Co.	13,504	23,427	1.28	2.27
Clark Oil & Ref.	159	472	.12	.35
Colo. Oil & Gas	330	690	.06	.18
Continental Oil	10,699	13,640	.55	.70
Eastern Gas & Fuel	2,489	4,090	.79	1.42
Empire State Oil	293	435	.15	.22
Genl. Am. Oil of Texas	1,660	2,530	.54	.83
Getty Oil	7,070	9,306	.46	.61
Gulf Oil Corp.	60,668	94,938	1.95	3.05
Hancock Oil	1,783	1,962	.49	.54
Honolulu Oil Corp.	3,398	3,844	.91	1.02
Humble Oil & Ref.	32,300	58,200	.45	.81
Imperial Oil Ltd.	15,022	21,581	.48	.68
International Pet.	7,000	11,100	.48	.76
La. Land & Exploration	4,800	5,471	.53	.61
Macmillan Petroleum	107	18	...	...
Maracaibo Oil Expl.	91	572	.19	1.15
Midwest Oil Corp.	1,875	2,102	.74	.83
Monterey Oil*	758	720	.42	.40
National Gas & Oil	219	198	.47	.43
Ohio Oil Co.	8,368	12,666	.64	.96
Phillips Pet.	20,516	28,379	.60	.83
Plymouth Oil	870	2,519	.35	1.02
Pure Oil Co.	4,732	10,170	.55	1.18
Quaker State Oil Ref.	289	370	.35	.45
Richfield Oil Corp.	5,605	7,039	1.40	1.76
Seaboard Oil Co.	2,008	3,393	.55	.92
Shell Oil Co.	26,470	41,450	.87	1.37
Signal Oil & Gas	2,900	3,176	.66	.72
Sinclair Oil Corp.	16,408	26,302	1.07	1.72
Sinclair Venezuela Oil	5,367	2,210	1.34	.55
Skelly Oil Co.	6,014	11,388	1.04	1.98
Socony Mobil Oil Co.	39,100	67,700	.81	1.48
Standard Oil Co. of California	57,411	69,473	.91	1.10
Standard Oil Co. (Indiana)	31,432	45,851	.88	1.30
Standard Oil (Ky.)	3,240	3,283	1.24	1.26
Standard Oil Co. (New Jersey)	167,000	237,000	.82	1.20
Standard Oil Co. (Ohio)	4,318	7,841	.85	1.59
Sun Oil Co.	3,574	13,331	.31	1.24
Sunray Mid-Continent	10,541	16,297	.56	.88
Superior Oil Co.*	5,028	6,166	11.91	14.60
The Texas Co.	70,003	86,424	1.25	1.57
Texas Pacific Coal & Oil	1,496	2,068	.42	.58
Tidewater Oil Co.	803	11,479	—.01	.85
Union Oil of California	5,994	9,327	.78	1.21
Union Oil & Gas of la.	2,216	1,711	1.22	.94
Universal Cons. Oil	482	981	.50	1.02
Wilcox Oil Co.	189	254	.64	.88
Woodley Petroleum	540	850	.78	1.04
TOTAL	$ 679,762	$1,049,863		

*3 mos. ended Feb. 28.

UNITED STATES OIL COMPANIES

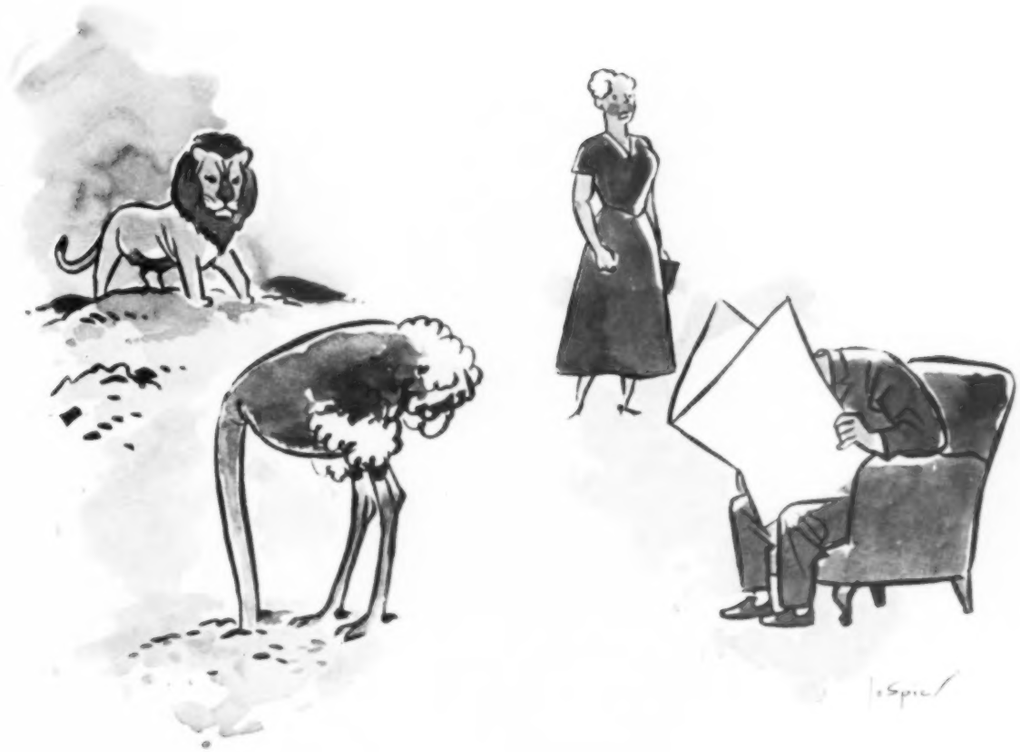
	Net Income	Per Share of Common	Net Working Capital	Net Capital Assets	Funded and or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Amerada Petroleum Corp.								
1957	**$ 29,948,979**	**4.74**	**53,740,407**	**92,461,991**	.....	.....	**6,313,010**	**135,663,152**
1956	26,499,395	4.20	46,967,439	145,962,503	.....	.....	6,309,400	118,020,502
1955	25,363,673	4.02	49,542,789	73,317,682	.....	.....	6,309,400	104,139,907
Anderson Prichard Oil Corp.								
1957	**5,242,505**	**2.93**	**11,774,438**	**59,474,806**	**16,200,000**	**200,000**	**1,644,256**	**31,805,586**
1956	5,880,382	3.41	10,918,839	51,328,468	9,300,000	200,000	1,642,216	28,960,523
1955	4,965,200	3.05	5,481,562	42,775,832	9,900,000	.....	813,433	31,792,750
Ashland Oil								
***1957**	**16,219,277**	**2.52**	**49,285,244**	**86,680,199**	**29,935,000**	**872,526**	**5,728,560**	**77,399,403**
1956	13,503,942	2.13	46,127,726	81,053,001	27,721,000	914,388	5,553,038	68,502,912
1955	10,106,032	1.56	49,520,893	70,132,006	29,717,512	774,512	5,427,383	61,541,609
*Year ended Sept. 1957.								
Atlantic Refining Co.								
1957	**35,670,000**	**3.82**	**102,302,000**	**544,539,000**	**182,000,000**	**352,000**	**8,986,970**	**358,387,989**
1956	47,210,000	5.11	123,498,000	478,560,326	147,500,000	352,000	8,970,328	341,632,453
1955	39,464,000	4.25	93,493,000	413,152,000	83,400,000	352,000	8,965,774	313,630,437
The Carter Oil Co.								
1957	**18,871,278**	**68.62**	**17,617,873**	**155,765,554**	**20,209,191**	.....	**275,000**	**125,304,451**
1956	14,389,627	52.33	18,097,557	141,856,738	16,334,352	.....	275,000	116,058,173
1955	16,135,000	58.67	13,334,000	131,309,000	.....	.....	275,000	108,543,546
Cities Service								
1957	**63,381,667**	**5.63**	**344,785,546**	**760,645,046**	**480,146,188**	.....	**10,518,804**	**510,742,310**
1956	65,832,436	6.03	379,867,824	673,032,656	459,375,103	.....	10,312,553	478,315,561
1955	53,260,690	4.88	306,809,242	636,632,938	390,622,971	.....	10,110,347	442,510,469
Colorado Oil & Gas Corp.								
1957	**2,855,407**	**.75**	**8,651,817**	**41,342,093**	**16,823,306**	**462,591**	**3,038,646**	**14,333,130**
1956	2,681,601	.70	8,527,706	38,452,874	16,086,827	466,295	2,985,014	11,241,221
1955	1,363,609	.28	.....	.....	.....	.....	.....	.....
Continental Oil								
1957	**46,723,749**	**2.38**	**104,254,497**	**323,407,861**	**151,752,241**	.....	**19,627,502**	**271,862,077**
1956	51,817,461	5.30	106,753,447	308,493,737	109,275,880	.....	9,777,301	303,554,210
1955	46,358,772	4.75	106,006,070	290,350,663	107,544,850	.....	9,756,466	280,400,181
Delhi-Taylor Oil Corp.								
1957	**3,948,324**	**.75**	**6,795,647**	**6,795,647**	**50,565,264**	.....	**5,316,842**	**16,251,229***
1956	2,043,368	.39	13,679,572	13,679,572	50,133,031	.....	5,316,842	13,302,905**
1955	1,646,795	.31	8,237,141	40,929,064	46,280,041	.....	5,316,842	10,701,537
*Includes consolidated retained earnings of $6,638,487 from Jan. 1, 1955.								
**Includes consolidated retained earnings of $3,690,163 from Jan. 1, 1955.								
Getty Oil Co.								
1957	**14,637,735**	**.93**	**19,756,358**	**60,889,330**	**38,713,153**	**1,282,807**	**15,155,968**	**45,359,997**
1956	7,887,947	.49	16,441,857	53,165,286	39,134,064	1,208,807	5,773,703	68,763,056
1955	11,182,071	1.85	20,571,570	46,704,483	38,693,110	1,285,807	5,498,876	62,489,188
Gulf Oil Corp.								
1957	**354,284,440**	**11.38**	**450,051,000**	**1,954,226,000**	**299,508,803**	.....	**31,130,789**	**1,412,029,184**
1956	282,658,000	9.08	393,788,000	1,726,746,000	286,270,630	.....	29,614,682	1,167,753,610
1955	218,064,000	8.19	439,525,507	1,147,973,174	175,460,998	.....	26,628,067	862,763,310
Hancock Oil Co.								
***1957**	**7,230,051**	**1.99**	**17,320,594**	**14,138,390**	.....	**200,000**	**3,501,821**	**31,259,474**
1956	7,079,848	1.95	27,498,597	12,765,568	.....	200,000	3,367,136	41,476,055
1955	6,112,474	1.74	28,174,101	7,669,698	.....	200,000	3,237,631	40,603,379
*Year ended June 30								
Honolulu Oil								
1957	**14,538,000**	**3.88**	**17,247,000**	**65,843,000**	**1,122,000**	.....	**3,750,972**	**44,775,018**
1956	13,816,000	3.68	13,203,000	61,815,000	1,468,786	.....	3,750,972	44,775,018
1955	13,699,000	3.65	11,301,068	57,100,348	1,468,786	.....	3,750,972	37,738,584
Humble Oil & Ref.								
1957	**175,910,393**	.....	**76,571,247**	**1,270,358,000**	**26,084,075**	.....	**72,000,000**	**868,135,720**
1956	178,961,132	4.99	49,689,819	1,166,800,000	27,064,232	.....	36,000,000	789,127,537
1955	174,997,500	4.88	78,133,959	1,092,523,903	23,282,042	.....	36,000,000	696,238,780
Kerr-McGee Oil Industries, Inc.								
1957	**6,244,648**	**2.55**	**37,696,954**	**68,271,461**	**44,835,897**	**674,580**	**2,373,868**	**53,014,843**
1956	4,679,994	2.16	20,047,162	50,798,806	36,847,788	674,880	1,812,020	18,518,559
1955	2,484,867	1.41	13,164,290	38,907,143	21,845,439	674,880	1,755,000	14,344,267
Louisiana Land & Exploration Co.								
1957	**19,333,051**	**2.16**	**6,969,016**	**22,648,636**	.....	.....	**8,955,923**	**29,849,547**
1956	14,649,473	1.64	3,768,588	19,429,482	.....	.....	8,953,573*	23,402,102
1955	13,438,505	4.51	6,454,515	13,595,120	.....	.....	2,981,216	20,214,764
*Stock split 3 shares for 1, effective May 15, 1956								
Middle States Petroleum								
1957	**1,251,272**	**.65**	**2,538,431**	**24,863,424**	**6,000,000**	.....	**2,409,058**	**13,908,118**
1956	1,034,094	.43	2,984,239	27,913,091	9,600,000	.....	2,409,058	12,334,953
1955	1,006,718	.42	4,438,711	28,184,964	11,200,000	.....	2,409,058	11,466,424
Ohio Oil								
1957	**41,490,280**	3.16	**64,848,259**	**356,012,348**	.....	.....	**13,126,753**	**257,286,040**
1956	41,215,655	3.14	73,807,023	239,555,629	.....	.....	13,126,753	236,798,565
1955	41,255,462	3.14	76,889,823	219,729,223	.....	.....	13,126,753	216,585,714
Phillips Petroleum								
1957	**96,209,353**	**2.80**	**211,526,597**	**1,101,611,959**	**332,733,864**	.....	**34,350,769**	**808,594,560**
1956	95,202,615	2.77	173,750,416	1,016,487,480	243,446,809	.....	34,343,286	770,471,495
1955	95,203,057	2.78	138,838,021	879,029,751	118,945,583	.....	17,142,787	443,872,017
Plymouth Oil								
1957	**6,027,000**	**2.40**	**17,220,000**	**56,575,786**	**19,240,000**	.....	**2,509,758**	**43,783,289**
1956	7,956,000	3.22	17,225,000	55,776,358	18,949,103	.....	2,471,872	43,061,031
1955	6,888,000	2.83	19,285,864	51,748,007	19,609,103	.....	2,438,399	39,260,130
Pure Oil Co.								
1957	**35,523,971**	**4.13**	**118,312,727**	**334,589,930**	**90,485,095**	.....	**8,602,469**	**284,838,510**
1956	36,559,879	4.26	105,986,327	317,591,013	86,040,662	.....	8,583,604	263,064,113
1955	35,164,226	4.05	96,019,234	298,661,239	79,582,207	.....	8,549,332	240,205,578
Quaker State Oil								
1957	**1,983,066**	**2.40**	**9,418,310**	**14,012,707**	.....	.....	**927,305**	**17,644,305**
1956	1,975,257	2.39	9,040,332	13,101,222	250,000	.....	927,305	17,311,239
1955	2,676,256	3.24	9,118,175	13,160,929	750,000	.....	927,305	16,985,982

	Net Income	Per Share of Common	Net Working Capital	Net Capital Assets	Funded and or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Richfield Oil Co.								
1957	**28,175,868**	**7.04**	**82,749,403**	**223,828,744**	**99,000,000**	.....	**4,000,000**	**148,659,624**
1956	26,573,621	6.64	73,125,446	100,813,460	78,000,000	.....	4,000,000	134,483,756
1955	29,609,669	7.40	73,175,594	192,329,432	81,000,000	.....	4,000,000	121,910,135
Seaboard Oil Co.								
1957	**11,159,000**	**3.05**	**11,037,000**	**70,181,009**	.....	.....	**3,733,149**	**80,269,741**
1956	9,369,000	2.56	10,953,962	61,921,046	.....	.....	3,733,149	69,751,071
1955	8,441,000	2.31	10,600,000	42,412,530	.....	.....	3,733,149	49,800,074
Shell Oil Co.								
1957	**135,085,000**	**4.46**	**293,765,000**	**769,395,583**	**166,087,000**	.....	**30,286,384**	**750,417,693**
1956	135,848,000	4.49	287,253,000	750,906,690	197,408,000	.....	30,286,384	675,905,680
1955	125,532,000	4.14	231,254,701	728,516,144	201,457,000	.....	27,533,076	608,360,603
Shamrock Oil & Gas Corp.								
1957	**8,774,977**	**2.54**	**10,614,475**	**63,056,428**	**29,324,750**	.....	**3,451,012**	**40,605,624**
1956	9,007,313	2.61	.....	54,949,841	24,899,500	.....	2,298,910	37,771,835
1955	7,755,514	2.28	10,558,826	49,168,230	18,734,250	.....	2,262,232	32,607,131
Signal Oil & Gas								
1957	**13,052,000**	**3.03**	**11,332,491**	**86,295,379**	**17,225,396**	.....	**4,384,092**	**87,286,692**
1956	10,693,606	2.61	11,813,746	78,539,830	18,991,630	.....	4,099,704	73,862,846
1955	9,640,400	2.48	14,433,012	68,104,396	7,547,151	.....	3,916,004	66,701,102
Sinclair Oil Corp.								
1957	**79,308,239**	**5.18**	**303,027,001**	**918,129,889**	**340,561,432**	.....	**15,565,285**	**884,524,462**
1956	91,070,812	6.17	311,975,758	884,307,069	355,168,755	.....	15,487,555	847,623,736
1955	80,709,954	6.01	231,714,070	812,893,649	248,676,951	.....	14,528,428	756,407,123
Skelly Oil Co.								
1957	**36,785,340**	**6.40**	**65,663,119**	**261,077,606**	**5,607,000**	.....	**5,746,117**	**181,492,561**
1956	34,093,414	5.93	59,729,863	240,887,684	6,327,000	.....	5,746,117	155,050,219
1955	32,240,262	5.61	49,923,625	232,029,953	8,485,000	.....	5,746,117	131,299,803
Socony Mobil Oil Co.								
1957	**220,432,894**	**4.63**	**704,125,574**	**1,670,659,561**	**181,965,464**	.....	**48,770,011**	**1,650,543,908**
1956	249,503,667	5.70	590,352,161	1,521,202,925	211,417,611	.....	43,797,585	1,412,382,714
1955	208,347,039	4.76	580,591,666	1,411,012,611	223,960,153	.....	35,512,203	1,392,996,711
Standard of California								
1957	**288,230,391**	**4.56**	**297,224,000**	**1,537,534,000**	**82,282,808**	.....	**63,224,386**	**1,463,747,817**
1956	267,890,801	4.24	308,584,439	1,394,069,804	76,721,925	.....	63,224,386	1,295,639,373
1955	231,138,655	3.66	283,228,000	1,270,319,631	78,562,217	.....	31,612,193	1,132,068,809
Standard of Indiana								
1957	**151,510,000**	4.27	**414,250,000**	**1,791,591,953**	**271,639,281**	.....	**35,769,010**	**1,118,034,528**
1956	149,430,000	4.33	460,190,000	1,667,135,029	298,900,000	.....	35,381,185	1,015,850,419
1955	157,120,000	4.81	478,711,532	1,554,905,062	391,210,108	.....	33,057,115	874,712,182
Standard of Kentucky								
1957	**12,625,856**	**4.85**	**21,749,325**	**61,638,588**	.....	.....	**2,604,790**	**62,567,892**
1956	12,478,021	4.79	24,355,671	55,345,635	.....	.....	2,604,790	58,407,603
1955	12,667,299	4.86	24,880,664	60,767,895	.....	.....	2,606,984	54,395,149
Standard of N. J.								
1957	**805,177,000**	**4.08**	**1,760,564,000**	**4,999,810,000**	**642,604,000**	.....	**203,488,000**	**4,431,191,714**
1956	808,535,000	4.11	1,650,180,000	4,355,137,000	584,996,000	.....	196,939,000	3,732,867,552
1955	709,310,000	3.61	1,642,457,000	3,872,998,000	557,924,000	.....	65,435,000	3,698,699,781
Standard Oil of Ohio								
1957	**23,920,335**	**4.79**	**58,073,975**	**252,539,240**	**63,000,000**	**204,596**	**4,827,093**	**188,944,954**
1956	26,591,560	5.35	54,019,436	212,949,797	28,000,000	207,914	4,820,303	177,689,968
1955	23,008,465	4.61	63,497,014	194,219,645	31,000,000	221,314	4,020,112	171,187,147
Sun Oil Co.								
1957	**47,492,384**	**4.17**	**128,083,190**	**435,512,130**	**47,330,840**	.....	**11,490,187**	**85,749,642**
1956	56,160,053	5.22	98,095,496	398,493,800	11,019,227	.....	10,845,051	90,943,321
1955	48,307,360	4.72	78,053,664	370,655,502	9,863,150	.....	10,236,433	87,530,079
Sunray-Midcontinent								
1957	**57,155,405**	**3.09**	**88,868,702**	**381,912,848**	**55,973,333**	**2,718,074**	**17,357,067**	**332,860,770**
1956	43,309,643	2.40	83,244,564	357,665,593	58,186,000	2,748,931	17,316,610	300,528,529
1955	39,471,783	2.27	84,288,907	337,485,528	60,346,667	2,816,898	16,442,425	279,036,365
Superior of California								
1957	**18,877,389**	**44.71**	**29,174,607**	**181,521,934**	**91,526,969**	.....	**422,264**	**118,679,455**
1956	5,040,752	11.94	21,961,800	159,968,851	81,856,598	.....	422,264	99,802,066
1955	3,395,000	8.04	30,411,232	116,483,009	49,654,254	.....	422,264	94,761,314
The Texas Company								
1957	**332,303,644**	**5.94**	**595,721,833**	**1,590,085,257**	**306,739,743**	.....	**56,355,506**	**644,481,475**
1956	302,262,620	5.51	598,547,070	1,435,466,845	363,855,182	.....	55,250,496	468,710,006
1955	262,729,738	4.79	538,658,293	1,215,969,460	208,968,985	.....	27,625,248	983,645,810
Texas Gulf Producing								
1957	**6,441,618**	**1.60**	**8,687,158**	**35,205,251**	**5,850,000**	.....	**4,028,948**	**26,013,564**
1956	5,657,708	1.46	6,808,713	32,046,073	6,450,000	.....	3,873,364	22,398,357
1955	6,320,029	1.72	5,138,473	29,450,148	7,050,000	.....	3,670,191	17,337,769
Tidewater Oil Co.								
1957	**31,942,000**	**2.54**	**78,193,000**	**592,905,000**	**245,573,000**	**2,495,608**	**12,661,630**	**262,674,000**
1956	35,789,000	2.84	91,812,000	520,842,000	217,231,000	2,495,708	12,058,695	236,761,000
1955	35,013,000	2.78	83,882,000	340,724,000	50,000,000	2,495,708	11,484,471	201,528,195
Union Oil Co. of California								
1957	**38,235,535**	**4.95**	**161,130,770**	**429,572,306**	**187,050,036**	.....	**7,716,743**	**164,313,218**
1956	34,240,878	4.45	168,838,512	400,766,077	189,864,723	.....	7,700,433	198,494,743
1955	30,522,963	3.93	88,304,805	379,741,538	135,782,286	.....	7,331,790	170,489,972
Wilcox Oil Co.								
1957	**891,025**	**3.02**	**2,844,282**	**5,757,087**	.....	.....	**295,450**	**7,833,582**
1956	783,082	2.75	2,431,866	5,288,279	.....	.....	284,935	7,214,728
1955	981,994	3.48	2,052,197	5,958,452	.....	.....	281,835	6,662,155
1957 Total for 43 companies	$3,345,100,346		$6,857,562,867	$23,773,362,961	$4,645,695,129			$18,083,120,848
1956 Total for 43 companies	3,237,862,657		6,585,941,973	21,482,068,147	4,394,091,418			16,088,585,315

MAJOR INTEGRATED COMPANIES IN CANADA

British American Oil Co.								
1957	**32,180,000**	**1.74**	**77,996,000**	**272,955,482**	**58,616,314**	.....	**18,448,158**	**152,405,200**
1956	25,134,091	1.36	55,992,591	242,875,073	30,729,717	.....	18,432,498	130,333,283
1955	20,613,219	2.27	60,636,633	155,701,327	41,583,780	.....	9,099,999	110,047,815
Canadian Oil Companies, Ltd.								
1957	**4,010,000**	**1.75**	**17,114,000**	**66,211,000**	**39,190,000**	**80,000**	**2,029,000**	**11,914,000**
1956	3,762,000	1.80	18,392,000	60,222,000	40,947,000	80,000	1,839,000	9,940,000
1955	2,806,000	1.30	17,767,000	58,370,000	42,000,000	80,000	1,806,000	7,717,000

(Continued on page 87)



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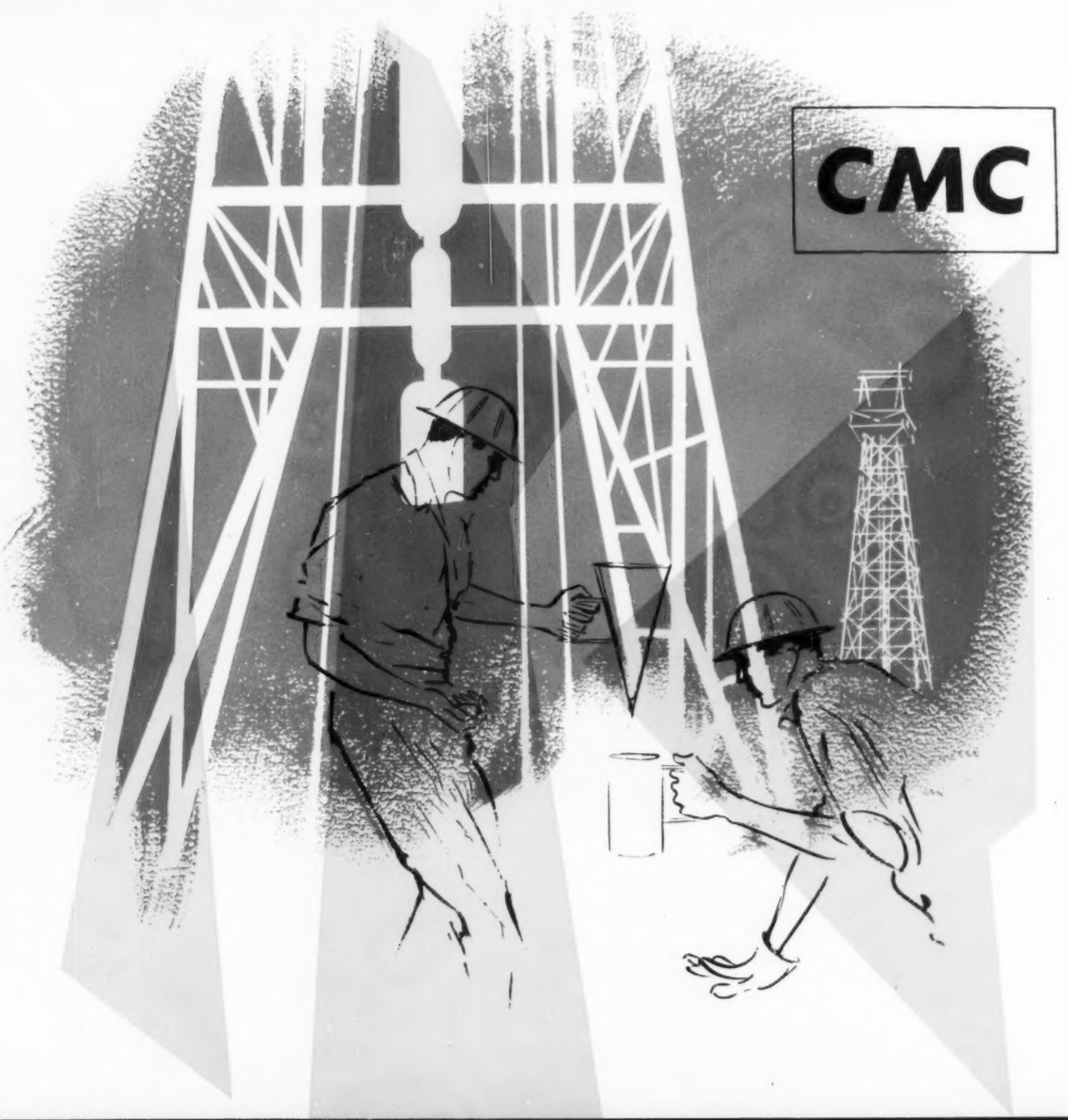

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Petrochemical growth in Europe

New investment soon will boost Europe's petrochemical industry past the billion-dollar mark. In the coming two years, the industry will more than double its capacity.

by Vernell Skulan

In Europe, an integrated pertoleum chemical industry is now becoming a reality. While squeezable plastic bottles and toys, synthetic fibers, and other petrochemical items became available here almost simultaneously as in the USA, they were on the whole being made from USA imported intermediate chemicals, and were in a more limited supply than in America. It is only within the past few years that Europe has been installing facilities to make, from refinery to the store shelves, many of the petrochemical consumer products. The reason for the delay is simple: In contrast to the United States, where World War II created a necessity which mothered intense and continued development and production of petroleum-derived chemicals, it hampered greatly European construction of new plants and research in this field. The immediate postwar years, of course, found Europe busy with clearance and reconstruction of bomb-wasted industrial and residential centers. Furthermore, Europe had to build its refining and cracking capacity before it could begin to manufacture petrochemicals on its own, so to speak, and this too was interrupted by the war. As in the USA, Europe's petrochemical centers are logically situated close to large refineries which supply the raw materials.

Despite these handicaps, however, the European petrochemical industry did get off the ground—although belatedly, compared with the USA; and it has already absorbed more than $450 million worth of plant and equipment. According to present plans, a further $600 million or so will be invested in the next two years. With new plants being continually announced and decisions of upward revisions of plant capacities during construction constantly taking place, it it conceivable that actual investment will be appreciably higher than the estimate.

Development of the petrochemical industry here will affect America in several ways. For one thing, it means a growing self-sufficiency in Europe, i.e., a lessening dependence on the imported intermediate and finished products, particularly from the USA. The raw material—crude oil—will still have to be bought outside the continent and the British Isles, and that of late has been coming in greater quantities from the Middle East and South America than from the states. Indigenous supplies of oil in Europe are too small to be given much mention; but, if France can retain its political grasp on the Sahara—and if the desert lives up to its mineral expectations—this may, in the rather remote future to be sure, provide a vicarious indigenous supply.

Offering a more real raw-material source, however, are the natural-gas deposits of France and Italy and, to a lesser extent, Germany. In fact, while still supplying a very small portion of the raw material for chemicals, the utilization of natural gas in this sense is growing even faster than is the use of refinery products. In 1956 nearly 130,000 tons* of natural gas were used for the manufacture of chemicals, 60% more than the amount used in 1955; while liquid feeds stock went up 15% in 1956 over 1955, to 880,000 tons. Because of its abundance within the country, Italy is particularly active in research and experiments in the use of natural gas for chemical synthesis, though the discovery of the Gaz du Lacq field of France in 1952 has whetted this country's interest in chemicals from natural gas, and thus the growth rate can be expected to continue.

Imports of American and Canadian ethylene and its derivatives and synthetic rubber will probably take the biggest cut when Europe completes its present round of new petrochemical building. The two largest uses of ethylene are polyethylene and ethylene oxide. Europe plans to be producing nearly 450 million pounds of polyethylene by the end of next year compared with approximately 175 million pounds now; and by 1960 hopes to bring the total capacity to more than 660 million pounds. In a speech delivered before the 30th International Congress of Industrial Chemistry at Athens last year, C. A. C. Haley, of Esso Research Ltd., noted that consumption of polyethylene in Europe in 1956 averaged just over 1 lb per head (a significant portion of this being supplied by American imports), compared with 3 lb in the USA. Mr. Haley stated also that, by 1961, consumption in Europe should equal the present USA demand per capita, and added that Europe should then be fulfilling these needs from domestic plants. Ethylene-oxide production in Europe at the end of 1959 will be increased by about 220 million pounds, or nearly double the present output.

Similarly S.B.R. synthetic-rubber capacity will jump sharply. If present plans go according to schedule, more than 560 million pounds per year of general-purpose synthetic rubber will be made in Europe in a few years' time—up from the present output of about 22 million pounds. England, France, Italy, and Holland will then be producing the synthetic on a commercial scale for the first time, while Germany will add to its current capacity.

While imports of these materials from the USA will certainly feel the pinch, the USA will not be left out in the financial cold. Take ethylene oxide: Most of the new production will be achieved by direct oxidation—using, notably, a patent process developed by Scientific Design Co., of New York. That means the European firms will have to pay sizeable overall royalties and licensing feeds. Many of the S.B.R. plants are also based on American technology and know-how—and that, too, calls for royalty payments. In addition, much of the building is being done by subsidiaries of American companies over here. Result: Some profits will certainly find their way back to the parent firms. Dollars are financing plants of other essentially European firms in which American outfits have an interest. To get an idea of the extent of American investment in Europe, take a look at the ownership of some of the chemical and petrochemical producers in the United Kingdom (note also the interplay of European shareholding):

Company	*Ownership (%)*
Shell Petroleum Co. Ltd.	Dutch 60 English 40
Monsanto Chemicals Ltd.	Monsanto Chemicals (USA) 66 2/3 Public (UK) 33 1/3
International Synthetic Rubber Co. Ltd.	Dunlop Rubber Co. Ltd. 45 Remaining 55: Goodyear (USA); Firestone (USA); Michelin (France)
Union Carbide Ltd.	Union Carbide Corp. (USA) 100
Grange Chemicals Ltd.	British Hydrocarbon 66 2/3

(Continued on page 59)

**Unit of weight used in this instance is tons, whereas elsewhere herein it has been converted to pounds. As natural gas is here compared with liquid feed stock, best common denominator is tons rather than cubic feet for the gas and barrels for the oil.*

Report for 1957

British Petroleum Company

British Petroleum group sales tonnage and net income for 1957 were both at approximately the same level as in 1956 despite the fact that adverse effects of the Suez crisis had to be sustained for a longer period in 1957 than in 1956. The decline in sales in the first half of the year was offset to a large extent by an increase in the second half.

Difficult trading conditions make it more than usually hazardous to attempt at this stage to forecast results for 1958. However, BP group sales for the 12 months ended March 31, 1958 amounted to more than 57 million tons as against 53 million tons in 1957. While prices this year have been depressed by the deterioration in trading conditions, BP has in mitigation had relief from the exceptional expenses incurred last year, when it was involved in large and expensive oil purchases, in very heavy freight expenditure and in many other expenses inherent in the Suez dislocation. Thus there are factors which should bear favorably on this year's comparative results, but it is too early to say whether or not they may be outweighed by further depression in market conditions.

BP group expenditures for capital improvements in 1957 amounted to £ 100,500,000, an increase of £ 14,500,000 over the previous year. Capital expenditures are expected to again exceed the £ 100,000,000 level in 1958, necessitating the retention in the business of a substantial proportion of the earnings.

The Board of Directors have recommended a final dividend of two shillings per £ 1 ordinary stock unit free of income tax, which, together with an interim dividend of one shilling paid in October, 1957, brings total dividend payment for the year to three shillings per ordinary share, free of income tax. The annual general meeting will be held in London on May 22, 1958.

THE BRITISH PETROLEUM COMPANY

BRITANNIC HOUSE • FINSBURY CIRCUS • LONDON • E. C. 2

THE BRITISH PETROLEUM COMPANY LIMITED
GROUP INCOME STATEMENT

FOR THE YEAR ENDED 31st DECEMBER

	1957	1956
Sales Proceeds	£792,992,000	£721,633,000
Deduct: Sales Taxes, Customs and Excise Duties, etc.	197,050,000	174,333,000
Net Sales	595,942,000	547,300,000
Dividends and Other Income	11,985,000	10,327,000
	607,927,000	557,627,000
Cost of Oil, Operating, Selling and Administration Expenses	434,437,000	381,480,000
Depreciation and Amounts Written off	43,463,000	37,288,000
Interest Payable	3,363,000	2,578,000
	481,263,000	421,346,000
Income Before Taxation	126,664,000	136,281,000
Taxation: United Kingdom and Overseas	71,480,000	79,631,000
	55,184,000	56,650,000
Income applicable to Minority Shareholders	550,000	456,000
Net Income for the Year	£54,634,000	£56,194,000
Attributable to:		
Consolidated Companies	52,018,000	52,718,000
Non-Consolidated Companies	2,616,000	3,476,000
	£54,634,000	£56,194,000

PRODUCTION

Crude oil production, which came again mainly from Kuwait, Iran, Iraq and Qatar, amounted in 1957 to 1,000,700 barrels daily. Due to the Suez crisis this was about 20,500 barrels per day less than in 1956 but still some 61,600 more per day than in 1955, the last normal year.

SALES

Sales of crude oil and refined products in 1957 amounted to some 1,089,000 barrels daily, approximately the same as in the previous year. Although U.K. and European sales were curtailed due to restrictions imposed owing to the Suez situation, the BP Group continued to expand its markets elsewhere. BP Canada opened its first service station early in 1957 and since then has opened various other stations.

REFINERIES

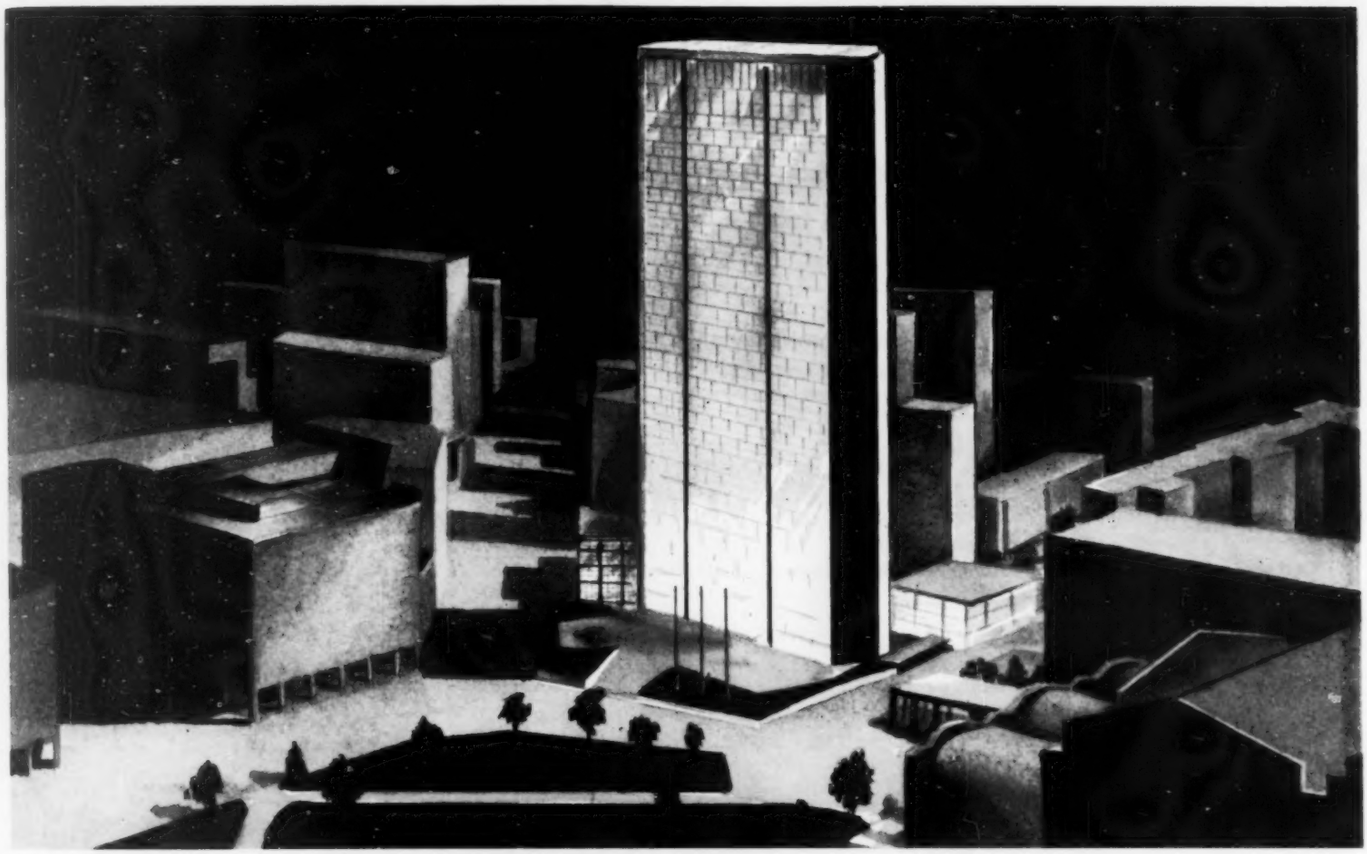
Refinery throughput from 16 refineries located in Europe, the Middle East and Australia in 1957 was 660,000 barrels daily, only 8,000 barrels per day less than in 1956. There were considerable variations in the different areas, with reductions at refineries west of Suez being offset by an almost corresponding increase at those east of Suez.

TANKERS

The Group's tanker fleet at the end of the year consisted of 157 ships totalling 2,411,000 deadweight tons. An additional 3,000,000 tons were on charter. Sixty-one new tankers totalling more than 2,300,000 tons are scheduled for delivery to the Group over the next five years. Amongst those will be twenty of 50,000 or more deadweight tons.

LIMITED

Copies of the Annual Report and Accounts may be obtained from the Purchasing Agent in U. S. A. for BP Trading Ltd., 610 Fifth Avenue, New York 20, N. Y.



MODERN DESIGN INFLUENCES

Out of the rubble of heavily bombed Milan has risen the ultra-modern office building seen above. This building, designed by Gio Ponti, typifies the modern accent on architecture found in Milan, the richest, busiest city in all of resurgent Italy.

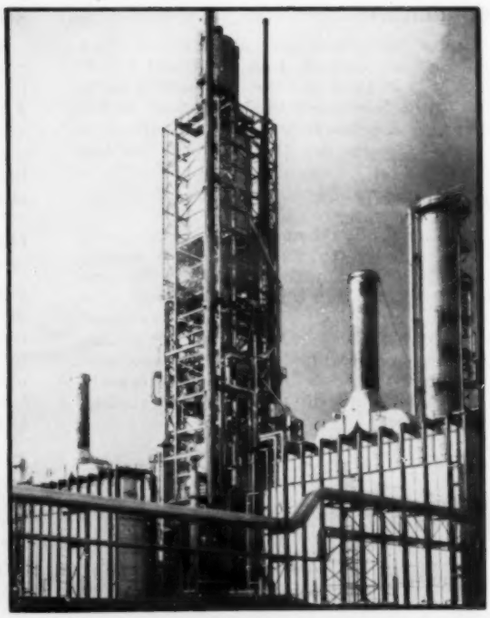
Just 6.5 miles from Milan, near the town of Rho, is the Condor refinery. Here, too, only the most modern design and equipment is used. That is the reason Condor selected two Born "Upflo" and one Born prefabricated, preassembled heaters for this refinery.

Born heaters are designed to:

1. Develop higher efficiencies
2. Have low construction cost
3. Have low operating cost
4. Have negligible maintenance cost
5. Use less ground space
6. Have exclusive safety features

In addition, into each Born heater is built the sound engineering principles gained through forty years of experience — experience in building heaters for any service and in sizes ranging from less than 1,000,000 to more than 150,000,000 BTU per hour absorption duty.

Whenever you have a process heating requirement write, wire or call your nearest Born representative.



BORN Engineering Company

Manufacturers of Direct-Fired "UPFLO" Heaters

TULSA, OKLAHOMA

BRANCH OFFICES:
Denver, Colorado; Houston, Texas; Los Angeles, California; New York, New York; Shreveport, Louisiana

IN CANADA:
Canadian Brown Steel Tank Co., Ltd. Brandon, Manitoba, Canada

(Continued from page 55)

Company	Ownership (%)
	Oronite Chemical (USA) 33 1/3
Forth Chemicals	British Hydrocarbon 66 2/3 Monsanto (USA) 33 1/3
Bakelite Ltd.	Union Carbide (USA) 51 Public (UK) 49
Distrene Ltd.	Distillers Co. Ltd. (UK Public) 55 Dow Chemicals (USA) 45

Even when the Common Market gets into full swing, American investment will not be excluded. What will happen—or what the planners hope will happen—will be that a united Europe will enable it to bargain on a more equal footing with its main competitors. A larger market, they anticipate, will make construction of larger plants an economic possibility, and they also hope that combined research will be nurtured in a less barrier-conscious Europe. At present the flow of ideas in the petrochemical field is pretty definitely one-sided—from the USA to Europe. In its most utopian sense, the Common Market would mean team work in every phase of activity, an adaption of the old adage of two-heads-are-better-than-one on a European scale. The result, they contend, will be a two-way flow of ideas or, certainly, a less USA-dominated scene than is now the case. On a small scale, the teamwork in Europe is already taking place. France—bearing in mind her vast Lacq field—reportedly has approached Italy on the most efficient utilization of natural gas. A German-English combination is constructing a petrochemical plant in Germany, and a French-English firm is producing petrochemicals in France. As for ideas across the ocean, the German Zeigler process has found favor with several American polyethylene producers, and M. W. Kellogg proudly advertises its new process of obtaining acetylene from natural gas or naphtha "through special arrangement with Société Bèlge de l'Azote," a Belgian organization. The Common Market, say the advocates, will help snowball movements which already have begun.

In terms of actual production, the individual European countries line up this way: United Kingdom, Germany, France, Italy, the Netherlands, Belgium, and smaller countries such as Austria. Despite a disparity in growth rates, there seems little chance this order will be changed in the near future.

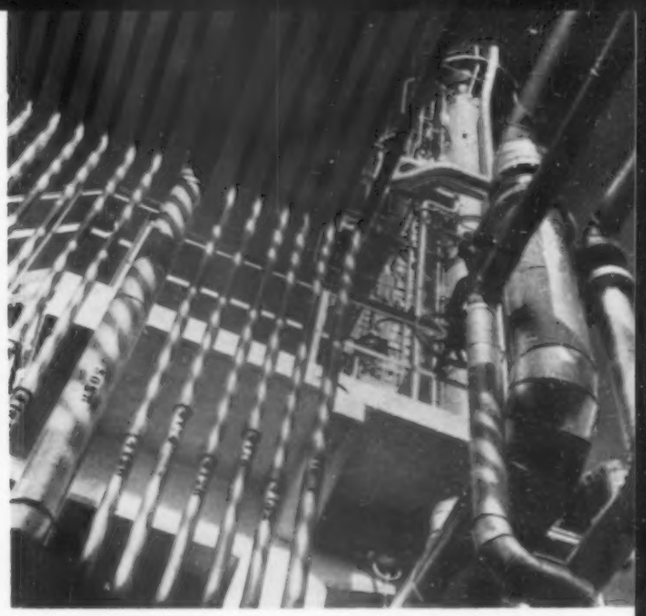
Here is what's happening in the petrochemical industry in the various countries of Europe:

United Kingdom: Imperial Chemical Industries Ltd., England's largest chemical manufacturer, announced plans last year for Europe's greatest single project—development of a £100 million petrochemical complex on a 1,000-acre site at Avonmouth on the River Severn. Little is known about what products will actually be turned out here, but the company plans to have its new plants in full operation by 1970. The proposed development may take the 'most heavily invested' title away from ICI's Wilton installations, where the company has already spent £70 million—with an additional £20 million planned to be invested before 1960. Since the first major petrochemical plants came onstream at Wilton in the early 1950's, expansion and new construction have been uninterrupted. Currently, the company is concentrating on a major expansion of its ethylene output there through the addition of a third cracking plant. The increase olefin availability from this plant will push polyethylene production to almost 200 million pounds in 1959—roughly 50% higher than present output. New ethylene capacity will also enable ICI to nearly double production of ethylene glycol which, in turn, will be used to expand production of terylene (the British equivalent of dacron) to 30 million pounds by 1959, a 20% increase. Butadiene, released in the cracking process along with ethylene, is separated by ICI in its new large-scale butadiene extraction plant put into operation last year. Once extracted, some of the butadiene will become feed stock for the manufacture of Butakon, a special-purpose synthetic rubber which ICC describes as butadiene copolymers. This is done at another new plant recently put onstream. Part of the butadiene is also going to Italy for a new synthetic-rubber plant there.

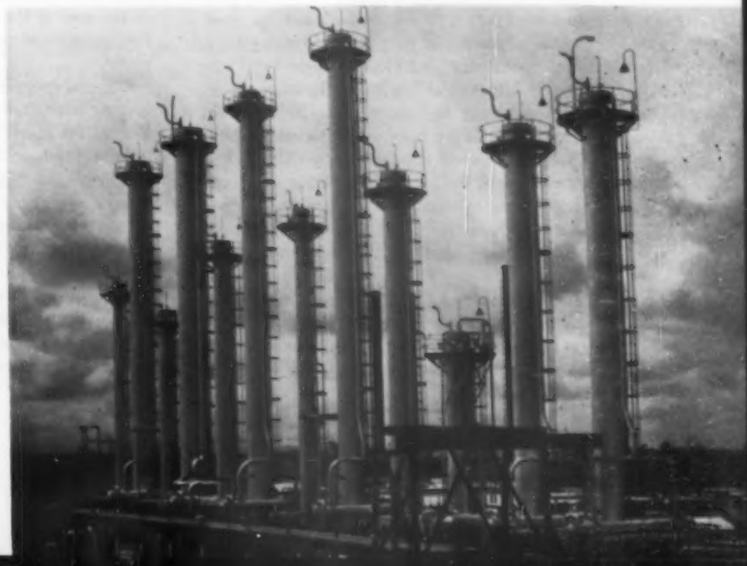
At nearby Billingham, ICI takes the propylene from Wilton to convert it into isopropyl alcohol—some of which is used for the production of acetione used ultimately in making 'Perspex,' a clear plastic which looks like a sturdy cellophane.

A huge petrochemical complex is shaping up at Fawley, where Esso's refinery provides a ready source of raw materials. This year, Esso expects to begin operation of a plant to turn out large amounts of butadiene, ethylene, and propylene. The butadiene, along with styrene from Forth Chemicals and Styrene Products, will end up as S.B.R. synthetic rubber via a 112-million-pound-per-year plant to be operated by International Synthetic Rubber Co. The rubber plant, now under construction, is planned to be opened late this year. Esso's refinery will also supply raw material for Monsanto's high-pressure polyethylene plant when it begins production next year, and for a new ethylene-oxide plant to be run by Union Carbide. This plant, too, is planned for 1959 completion.

A third rapidly developing petrochemical



Shell Berre chemical plant, showing columns for the rectification of solvents (Shell photo).



View of the distillation unit of Shell's new chemical plant at Stanlow: In left background is the butadiene hydrogenation and polymerization unit (Shell photo).

area in the United Kingdom is at Grangemouth, in Scotland. Here, British Hydrocarbon Chemicals, a joint venture of British Petroleum and Distillers, finished and put into operation last year a second cracking unit to satisfy an increasing demand by new and expanded neighboring petrochemical plants. The ethylene will be used in four different plants: an existing ethanol plant and a new Phillips low-pressure polyethylene plant operated by BHC; a recently expanded styrene plant operated by Forth Chemicals; and Union Carbide's modified high-pressure polyethylene plant now under construction. Butadiene extracted from the C_4 stream is being channeled to four existing synthetic-rubber plants—all put onstream recently. Three of these make specialized synthetic rubber, and the fourth is a test plant for the proposed International Synthetic general-purpose rubber installation. BHC last year also completed a propylene tetramer plant to feed a Grange Chemicals plant for dodecyl benzene, an intermediate in the manufacture of synthetic detergents.

In Europe, about 40% of the 'soap' market has been captured by synthetic detergents—most of these based on dodecyl-benzene sulfonates. The demand is expected to rise sharply in the next few years. At Shell Haven, near London, Shell Chemical recently increased production at the detergent alkylate plant it put onstream in 1956. This supplements existing production at other Shell plants in Venezuela—where the company became the first to manufacture proplyene-tetramer detergent alkylate outside the USA—Holland and France.

Shell is particularly active in northern England—at Stanlow in Cheshire County—the site of one of its English refineries, where it makes a range of propylene derivatives. Through a pipeline, Shell hopes by the end of this year to be exchanging products with the nearby Partington petrochemical center, some 25 miles distant. Presently, raw materials from the refinery are shipped by canal barge to Partington. At Partington, Petrochemicals Ltd., a Shell subsidiary which concentrates on ethylene-derivative projects, is doubling its ethylene-oxide production. When the expansion is complete, output will be in the neighborhood of 110 million pounds annually. Approximately one-fifth of the combined new production will be turned over to the production of propylene oxide, used for propylene glycols and propylene-glycol ethers. The remaining ethylene oxide will be turned into the following: ethylene glycol, 40%; solvents for paint, etc., 30%; liquid detergents, 10%; and miscellaneous, 20%. Through Styrene Products, a wholly owned subsidiary of Petrochemicals Ltd., the company plans construction of a monostyrene plant. This is the plant which will supply some styrene to the previously mentioned International Synthetic Rubber unit. Last year, Petrochemicals Ltd. also completed and put onstream a Ziegler pilot polyethylene plant—bringing this low-pressure process to England for the first time.

Germany: Activity in the petrochemical industry in Germany also continues at a fast pace. Several major projects—estimated to double investment to date—have been announced, and are scheduled to be completed within a few years. Much of the development is being carried out by the Fabwerke Hoechst group. Together with expansion of its cracking facilities, the company has plans for substantial increases in the production of polyethylene and Trevira, the name under which ICI's terylene is known in Germany. The company developed, and was the first to use, the Ziegler process for making polyethylene, and last year became second in the world (a few months behind Italy) to open its new 16.5-million-pound polypropylene plant. At Gendorf, in Upper Bavaria, a Hoechst subsidiary, Anorgana, is in the midst of constructing a large oil cracker and petrochemical unit. When completed in mid-1958, the plant will turn out ethylene oxide and glycol, detergents, polyvinyl chloride, polypropylene, and other chemical derivatives. The plant will depend on a natural-gas deposit near Gendorf for a considerable amount of the raw material for its products.

A new ethylene-oxide plant has also recently been put onstream by Chemische Werke Huels, and an existing Scientific Design ethylene-oxide plant operated by Chemische Fabrik Holten is due for expansion in the near future. The latter firm is a subsidiary of BASF.

In another part of Germany, at Dormagen near Cologne, British Petroleum and Bayer have joined forces, and are now putting up £20 million worth of oil-cracking and petrochemical installations which will be operated by their new subsidiary, Erdoelchemie. BP will supply the raw material for a Lurgi-Ruhrgas heavy-oil thermal cracker, now being installed. The ethylene from the cracker will be used to make ethylene oxide in Bayer's new direct oxidation plant—using the Scientific Design process. Bayer will then convert the oxide into glycol for further conversion into ethers, esters, and emulsifiers.

Esso is making its first appearance in the German petrochemical industry. Near Cologne, the company is constructing a refinery which includes a steam cracker to produce a range of olefinic raw materials. Another company, Scholven-Chemie AG-Gelsenkirchen-Ruer, will start production at the end of the year of more than 13 million pounds of polyethylene by the Ziegler route.

General-purpose synthetic rubber is receiving attention from Buna Werke Huels GmbH. At Marl, the company is putting the finishing touches on a plant which will start this year to turn out about 100 million pounds per year. The unit is close to the present 22-million-pound-per-year rubber plant operated by Chemische Werke Huels AG. Buna is half-owned by Huels, with the remaining interest divided equally among BASF, Bayer, and Hoechst.

France: France plans to invest some $240 million in its petrochemical industry before the close of 1959. That's nearly five times the $50 million put into the industry as of the end of 1956, and is comparatively the most ambitious investment program of any European country.

An interesting event of last year was the opening of a carbon-black factory on the Etang de Berre, the first in France. Cabot France, the operator, hopes ultimately to double capacity—thus affording a domestic supply for the foreseeable needs of the French motor and printing industry. Until the end of the year—when it is anticipated the nearby Shell-St. Gobain refinery will supply it—the raw material will have to be imported from the USA.

Large-scale developments circle around Esso's refinery at Port Jerome, between Rouen and LeHarve. To keep proposed petrochemical plants supplied with raw materials, Esso is undertaking construction of a new cracking plant and other units, including some for the recovery and purification of ethylene and butadiene.

Two new polyethylene plants will absorb the major portion of the ethylene. They will be operated by Société Normande de Matières Plastiques, using the Ziegler process; and using the ICI process for polyethylene will be Société Ethylene Plastique Normandie. The Air Liquide combine of Paris has interests in both producers.

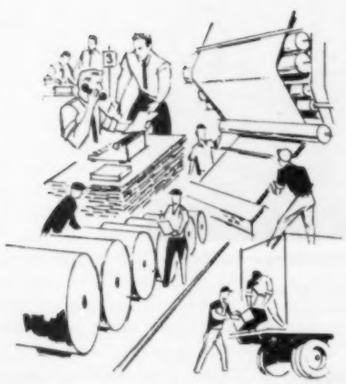
The butadiene (about 18 million pounds) from the Esso refinery is expected to supply in part a new S.B.R. plant being built for Soc. du Caoutchouc Butyl (SOCABU), Port Jerome. The plant will have a capacity of between 90 million and 110 million pounds per annum. The difference between what Esso will provide and actual requirements (a plant this size needs 70 million to 80 million pounds of butadiene) will reportedly be produced by SOCABU in a new and neighboring plant. SOCABU is also erecting a butyl rubber plant in the area. When this is completed in October of this year, it will provide Europe with its first domestic source of the synthetic.

Until recent years, butyl rubber's main use was for inner tubes. With the advent of tubeless tires, this petrochemical is now going into specialized applications of the automotive industry and the like.

At LeHarve, the refinery of the Compagnie Française de Raffinage is the centerpiece from which new petrochemical plants will draw their raw materials. Ethylene will go to a new polyethylene plant and to an ethylene-oxide (Scientific Design) plant. CFR itself is planning a tetrapropylene plant here to feed a proposed dodecyl-benzene plant of a new subsidiary, owned also by another French firm and the American Oronite.

Around Marseilles, Naphtachimie, owned chiefly by British Petroleum and Pechiney, plans major extensions of ethylene and propylene capacity.

In the southwest of France, comparatively far away from any industrial center, is located a potentially important stimulus to the French petrochemical industry—the Lacq field. Although priority has been



Literally everyone connected with a newspaper goes unseen except the newsboy who sells it. Editors, reporters, copy boys, makeup men, engravers, typesetters—this is but a fraction of the hidden army that brings you the news.

there's more to Cities Service than meets the eye!

A newspaper is much more than a few ounces of paper and a bit of printer's ink. It is the end product of acres of forests converted into newsprint, of world-wide news and photo organizations, diligent local staffs, skilled editors and typographers, block-long high-speed presses, and fleets of vehicles to rush the printed paper to readers while the news is "hot."

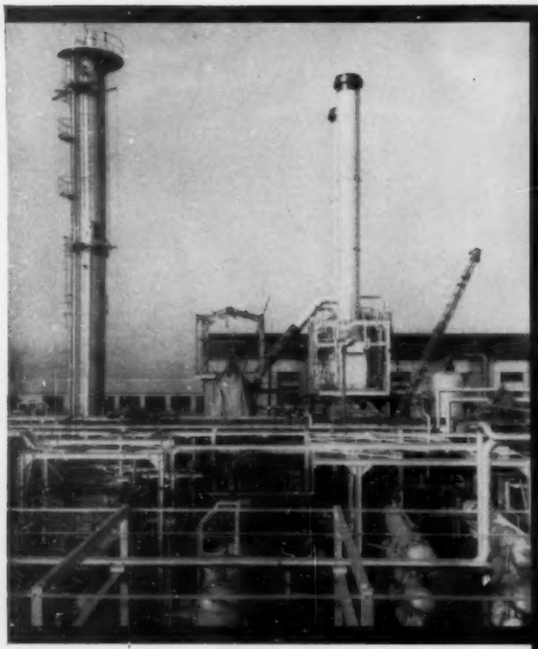
There is much more, also, to a gallon of gasolene than a chemical analysis would show. The motor fuel supplied at Cities Service stations is the end product of a job which reaches out to four continents. All this required a capital investment from Cities Service of more than $179,000,000 in 1957 alone.

Only in this way can the petroleum needs of the public be met—and petroleum, next to food, is the most vital product in America today.

CITIES SERVICE

In Germany...

ANOTHER JOB WELL DONE BY PROCON



Heat exchanger in foreground, fractionation tower at left and heater stacks on right during construction.

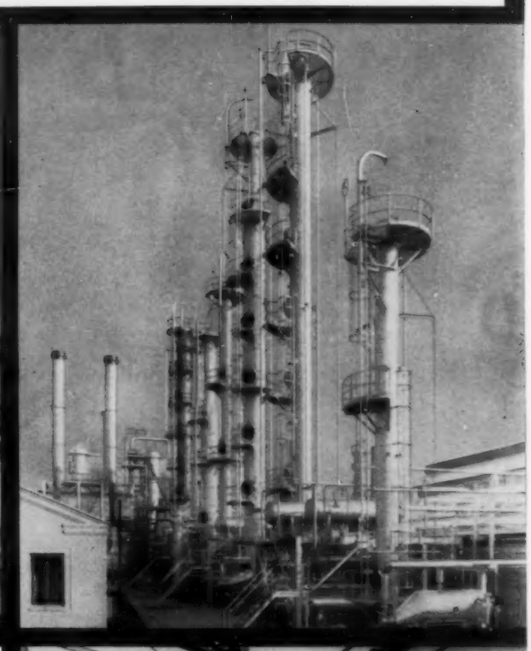
Procon construction helps rebuild Deutsche Erdöl A.G. refinery at Heide, Germany

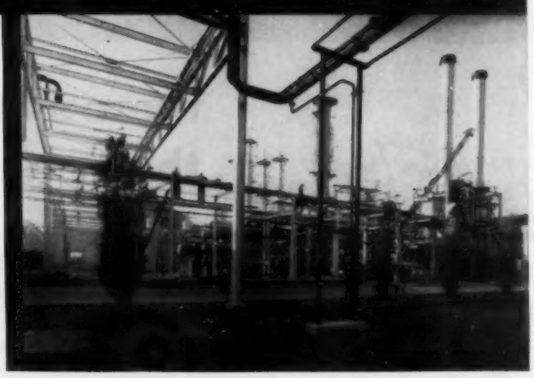
With a well-planned reconstruction program the Heide refinery of Deutsche Erdöl A.G. Hamburg, is rapidly regaining leadership among European petroleum refiners.

Latest advances in the DEA reconstruction are the Platforming® and Unifining* units recently completed by Procon. With these new units DEA can now supply Northern Germany (Schleswig-Holstein) and parts of Denmark with premium grade gasoline. Formerly premium gasolines for this area had to be transported from great distances. Procon construction was completed on time and up to every specification.

For petroleum refinery, petrochemical or chemical plant construction the world over, remember, "For really fine class work, finished against all odds and finished on time . . . call on Procon."

*Trademark





Top—Fractionation section of the finished Platforming and Unifining units.

Bottom—Nearing completion, heat exchangers, left, in series with the fractionation section and heaters on the right.

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WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

given to the recovery of sulfur (the gas has a very high content of hydrogen sulfide), plans also being discussed include use of the gas as a raw material in the manufacture of synthetic rubber and plastics.

Italy: While France begins to exploit the petrochemical possibilities of its relatively new discovery at Lacq, Italy is going ahead with the construction of new petrochemical plants using, as feed stock, natural gas from older fields in the country.

At Ravenna, ANIC's new S.B.R. and synthetic fertilizer plants will use natural gas from the Po valley as raw material. Since plans were first announced several years ago, capacity of the fertilizer plant has been nearly doubled, and that of the synthetic-rubber plant increased to more than 120 million pounds. The fertilizer unit is expected to be in production within a few months.

The S.B.R. unit—operating under license from Phillips Petroleum—is apparently already partly in production. Butadiene is now being shipped to Ravenna from Port Neches, Texas, and from ISI's Wilton installation. Styrene is also being purchased. Ultimately, however, ANIC plans to produce its own butadiene—either from natural gas via an acetylene route, or by the Houdry dehydrogenation process, or possibly both; and styrene will be made in a Koppers plant under construction.

Italy's proudest achievement of last year was the world inauguration of the commercial production of polypropylene. The product, given the trade name of Moplen, is a thermoplastic with similar uses to polyethylene, but with alleged superior qualities. Among these are a lower specific gravity than polyethylene, higher resistance to heat, better molding properties, and an excellent resistance to grease and oil. Moplen is being made by Montecatini, Italy's largest chemical producer, at Ferrara. It was perfected by Professor G. Natta and his colleagues at the Politecnico of Milan. Further, this group states they have been able to alter the polypropylene molecule to give it elastomeric properties, and they claim also to have developed a polypropylene fiber.

Talk of development of the refining and petrochemical industry in Sicily has been fast and furious, and it is difficult to know which of the many projected schemes will actually be carried out. Obviously, not all will be realized, if only from the viewpoint that this small island could not physically hold the amount of construction discussed. Two of the plans heard most often: Celene SpA, a new company owned jointly by Union Carbide and Italian Edison, announced it will build a polyethylene plant; and ABCD, which first stated it would construct an 11-million-pound polyethylene plant, now claims the unit will turn out twice that amount.

The Netherlands: Here petrochemical interest is focused on a 112-million-pound S.B.R. synthetic-rubber plant the Royal Dutch Shell group is planning near its refinery at Pernis, and another one—which will use Goodrich know-how—at Arnhem. For the latter, Goodrich Chemical and Algemene Kunstzijde Unie (AKU) are in the process of setting up a new, and as yet unnamed, joint company to handle the operations. The Royal Dutch-Shell project will add to a variety of existing plants. At Pernis, the company already makes Epikote resins—including its intermediate epichlorhydrin, which until last year was imported from the states; synthetic glycerin from propylene, detergent alkylate, polyvinyl chloride, solvents, and other products.

Staatsinijnen, of Limburg — which has been operating a pilot polyethylene plant using the Ziegler process—now has apparently changed its mind, and has announced it will build a commercial-size ICI high-pressure polyethylene plant instead. The product will be called "Stamylan," and production is due to start late this year.

Belgium and Austria: Brief mention has already been made of the Kellogg-Société Belge de l'Azote acetylene-ethylene process, the core of which is an SBA-designed continuous-operation burner. In the process, acetylene and ethylene are produced simultaneously from either natural gas or naphtha. When natural gas is used, acetylene is the main product. When the feed stock is naphtha, the ratio of acetylene to ethylene can be varied.

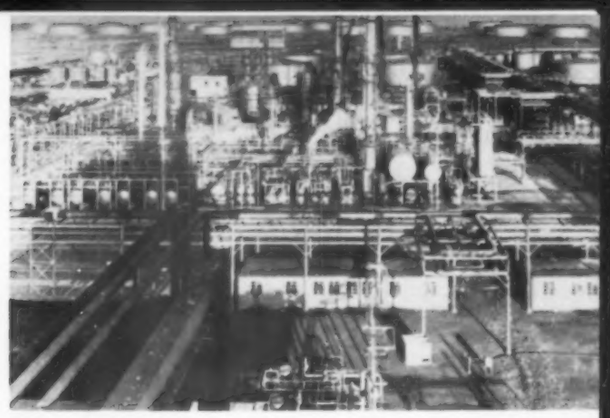
Société Chimique des Dérives du Pétrole (Petrochim) last year put onstream the first unit (for the manufacture of synthetic detergents) of a petrochemical complex at Antwerp. The remaining units, nearly complete, include a Scientific Design ethylene-oxide plant and a synthetic phenol plant. Petrochim is owned mainly by Belgian and American interests, with some French participation. The above plant—together with one for Solvay & Cie. which started production last September—are the first petrochemical units to be operating in the country. The Solvay unit turns out solvents for the paint, wax, and plastics industry.

Numerous schemes for the production of petrochemicals in Austria have been discussed. Two of these appear to have foundation—and, in fact, one has reportedly got under way. Vedepha, a company which represents the Fabwerke Hoechst interests here, announced it will build a plant near Vienna for the manufacture of polyvinyl acetate. Hoechst has also been linked with rumors about the construction of a £2 million low-pressure polyethylene plant. The second plan is a joint operation of Stickstoffwerke Linz and Montecatini, who reportedly want to put up a £2.75 million plant to turn out ethylene oxide, polyethylene, and polypropylene. Both plants, if and when they materialize, would be supplied with raw materials from the Austrian Mineral Oil Administration refinery proposed for Schwechat near Vienna—to go onstream within the next three or four years.

Eastern Europe: From behind the Iron Curtain, this much is known: Hungary is currently constructing a plant to produce solvents and plastics and nitrogen fertilizer based on natural gas. The gas will come from Romania through a 220-mile pipeline, also building. Part of the raw material will go to make synthesis gas for the fertilizer, and part will be used to make acetylene for the production of polyvinyl chloride and solvents. The entire project will be built with the help of Russian capital.

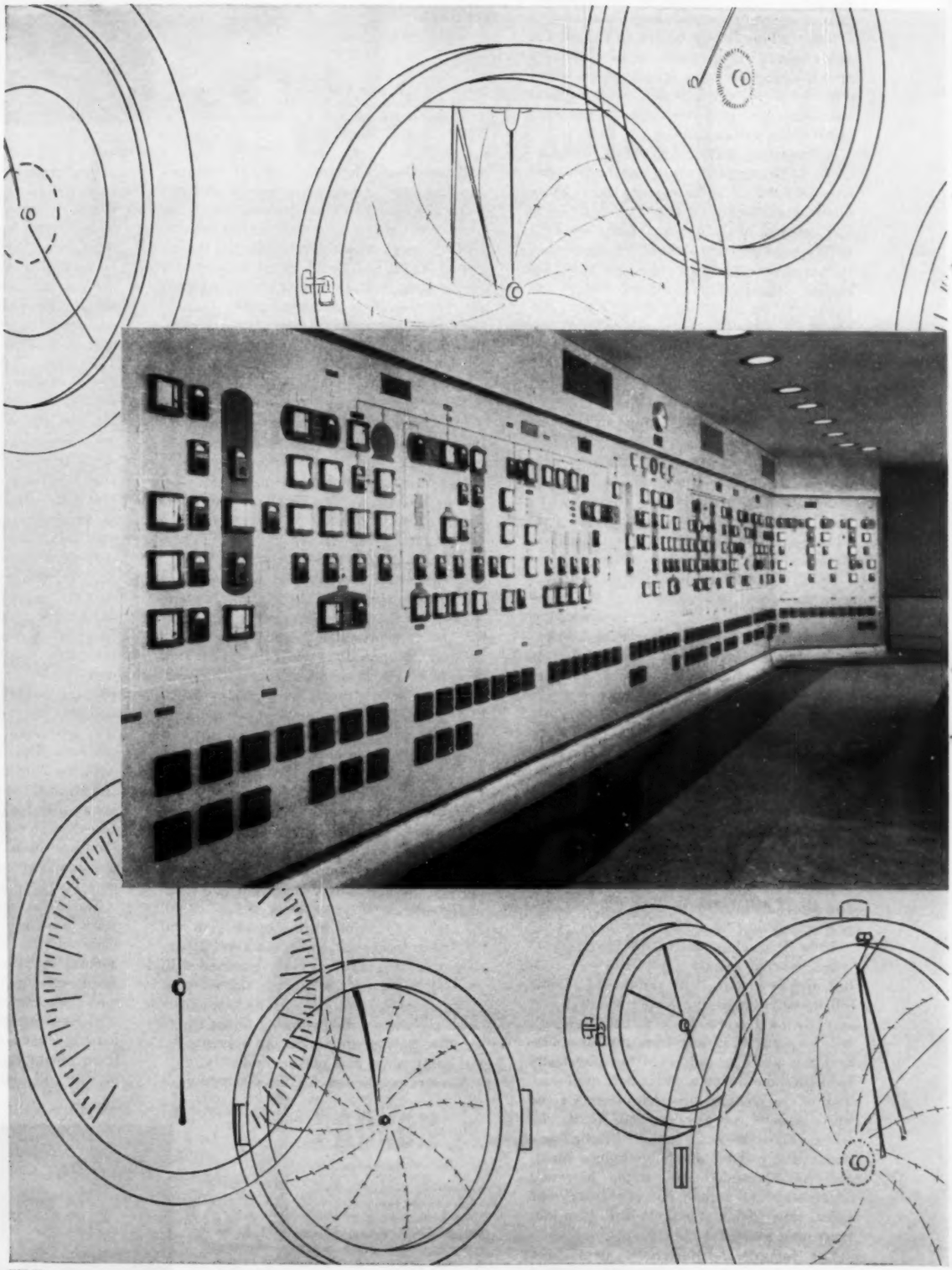
In East Germany, chemical producers are apparently looking to petroleum as an alternative to coal, their major raw material for chemicals at present. A petroleum cracking unit and an aromatics plant reportedly were put onstream recently.

The Poles announce they have started work on an 80-million-pound-per-year plant which will produce semi-finished general-purpose synthetic rubber. The plant, expected to start manufacture in mid-1960, has been equipped by the USSR. The Russians themselves also claim their first synthetic-rubber plant using petroleum chemicals has been opened. It employs a fully automated process. END



Butadiene unit, with tank farm in background, at British Hydrocarbon Chemicals Ltd. plant at Grangemouth (British Petroleum photo).

British Hydrocarbon Chemicals Ltd. refinery at Grangemouth, Scotland—showing, in center foreground, the purification and rectification ethanol plant; in left foreground, the fractionation ethylene plant; and in right foreground, the isopropyl alcohol and detergent alkylate plants (BP photo).



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MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

—Aromatic hydrocarbons:

synthesis
separation
purification
reactions

by Heinz Heinemann and Harold Shalit

Fig. 1: US Patent 2,768,220, Dated October 23, 1956, Granted to A. C. Nixon et al.

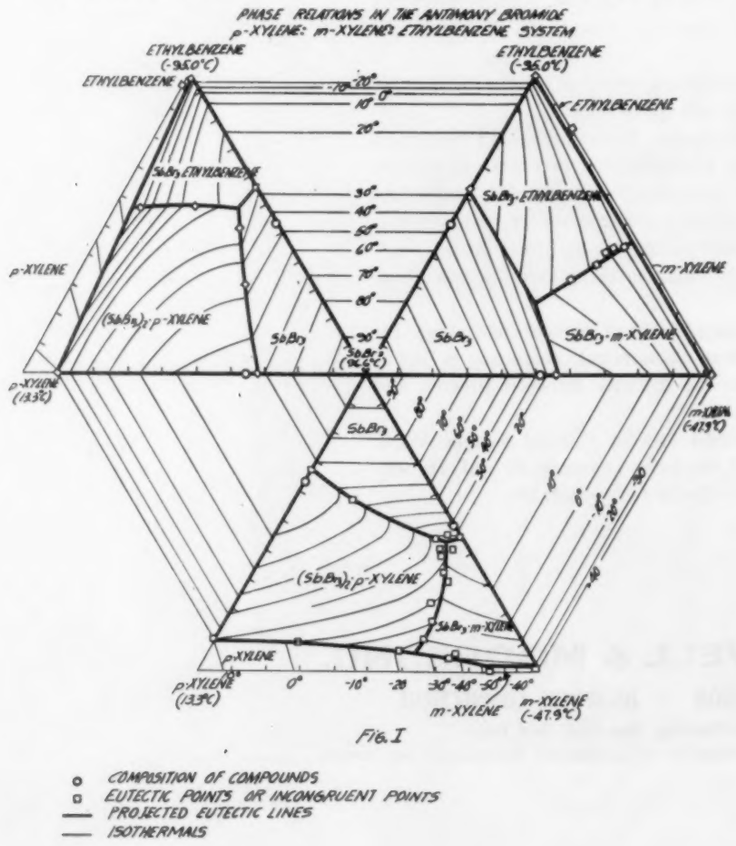

Fig. 1

- COMPOSITION OF COMPOUNDS
- EUTECTIC POINTS OR INCONGRUENT POINTS
- PROJECTED EUTECTIC LINES
- ISOTHERMALS

THE current patent review on petrochemicals is again concerned with that important class of compounds, the aromatic hydrocarbons. Petroleum is becoming a prime source of these versatile materials and their properties are concerning an increasing number of petroleum companies. This subject was last reviewed here about a years ago, and since then a very large number of patents dealing with aromatic hydrocarbons have been issued. A selection has been made from this number on the basis of interest to petroleum companies. Only those reactions are considered here in which hydrocarbons are both reactants and products. Such important reactions as nitration, sulfonation, chlorination, etc., and not discussed currently but will be incorporated in a latter review. The patents are grouped in three main sections:

1. Preparation of Aromatic Hydrocarbons
2. Separation and Purification
3. Reactions

Preparation of Aromatic Hydrocarbons

In this section are considered ten selected patents dealing with the synthesis of aromatic hydrocarbons. G. J. De Jong and J. Koorevaar (2,761,885 to Stamicarbon N.V.) claim to prepare xylenes by condensing toluene with formaldehyde to form ditolyl methane and other tolyl methanes of higher molecular weight. These compounds are then contacted with an aluminum silicate cracking catalyst at temperatures above 300°C. Similarly, in 2,761,884, J. Koorevaar prepares ditolyl methane by passing a suspension in toluene of a solid formaldehyde polymer upwardly through a column of 70-80% sulfuric acid. The concentration

BP MAPS THE FUTURE

Children of Medina, the new township near Kwinana Refinery, outside their splendid modern school.

A new township springs up in Australia

SEVENTEEN MILES south of Fremantle, the main port of Western Australia, is Australia's biggest refinery – Kwinana – owned and operated by one of the British Petroleum group of companies.

Nearby a new township has risen amid the gum trees and casuarinas of the Australian bush. Named Medina, it has been built by the Western Australian authorities as the first part of a large new town to house many thousands of people whose livelihood will be mainly bound up with oil.

This new town has been planned not only for personnel of Kwinana Refinery, but also for employees of the new industries attracted to the area by the building of the refinery, with its ready supply of fuel oil and other products.

Kwinana started operating in 1955, and can now process 60,000 barrels of crude oil a day. Important new plant is at present being added to meet Australia's ever increasing demand for oil products.

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of the acid is maintained by adding concentrated sulfuric acid and withdrawing the diluted, spent acid.

Aromatics are produced in high yields according to a procedure patented by C. H. Watkins (2,766,308 to Universal Oil Products Co.). His process consists of oxidizing a stream of normally gaseous paraffin hydrocarbons with controlled amounts of oxygen at 1400°-1600°F in order to produce gaseous olefins. The olefinic stream is passed into a confined cracking and aromatization zone at pressures below 400 psig. The temperature in this zone is maintained below 1600°F by mixing in incremental portions of an aromatic rich stream. A major portion of the non-aromatics contained in the aromatic rich stream are aromatized; the olefins formed in the first step are simultaneously aromatized.

In 2,775,629, J. A. Anderson, Jr. of the Esso Research and Engineering Co. increases the aromatics content of a feed stock boiling between 100° and 900°F. This is accomplished by heating the charge to 1100-1200°F at pressures from 0-300 psig for 1-50 seconds. The reaction is carried out in the presence of hydrogen and in the absence of catalytic materials.

L. Schmerling (2,781,407 to Universal Oil Products Co.) claims the preparation of aromatic hydrocarbons with at least one alkyl substituent by condensation of an alkyl furan with an olefin. The resulting epoxide is aromatized in the presence of an acid, e.g., HCl, at 0-150°C. In 2,785,209 and 2,785,210, A. Schmetterling and H. Krekeler of Farbwerke Hoechst, A. G. make aromatics from 2,2,4 trimethylpentane and the corresponding trimethylpentenes by contacting the vapors with a catalyst comprising 5-40% chromium oxide, 1-10% potassium oxide, 0.5-5% cerium oxide, and 93.5-45% of gamma alumina. The reaction takes place in the presence of carrier gases at 450°-650°C for contact times from 0.1-60 seconds. The aromatic formed is said to be p-xylene.

A synthesis process for aromatics is claimed by H. I. Weck and H. S. Seelig of Standard Oil Co. (Indiana) in 2,768,961. They contact a mixture of H_2 and CO in volume ratios between 1:4 and 4:1 with a catalyst comprising 1-15% chromium oxide on gamma alumina containing 0.1-1 wt.% of an acid acting flouride or chloride and less than 0.3% of alkali metal as the oxide. Temperatures are between 600°-900°F and pressures at least 400 psig. In a similar patent, 2,791,583 (to Standard Oil Co. of Indiana) H. I. Weck claims for this reaction the use of a chromia-alumina catalyst free of alkali metal and promoted by 0.1-5% of an oxide of cobalt, nickel, molybdenum, or cerium. Temperatures are in the range 650°-850°F.

M. J. Schlatter in 2,768,985 (to California Research Corp.) claims to prepare m-alkyl tertiary benzenes by contacting a monoalkyl benzene with an excess of a tertiary butylating agent under alkylating conditions to produce alkyl di-tertiary butyl benzenes. These are then distilled to separate a 1-alkyd 3,5 di-t-butyl fraction. This is contacted with an excess of benzene, toluene, o- or m-xylene, or phenol under mild alkylating conditions, i.e., temperatures below 70°C, to produce the m-alkyl,t-butyl benzene and an alkyl transfer product.

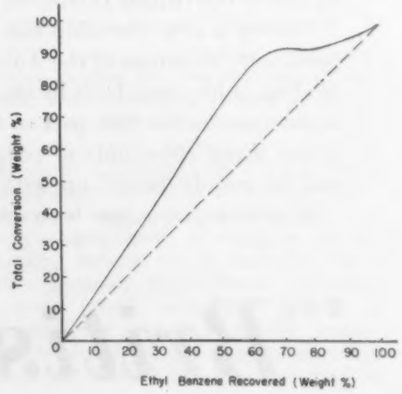
Separation and Purification of Aromatics

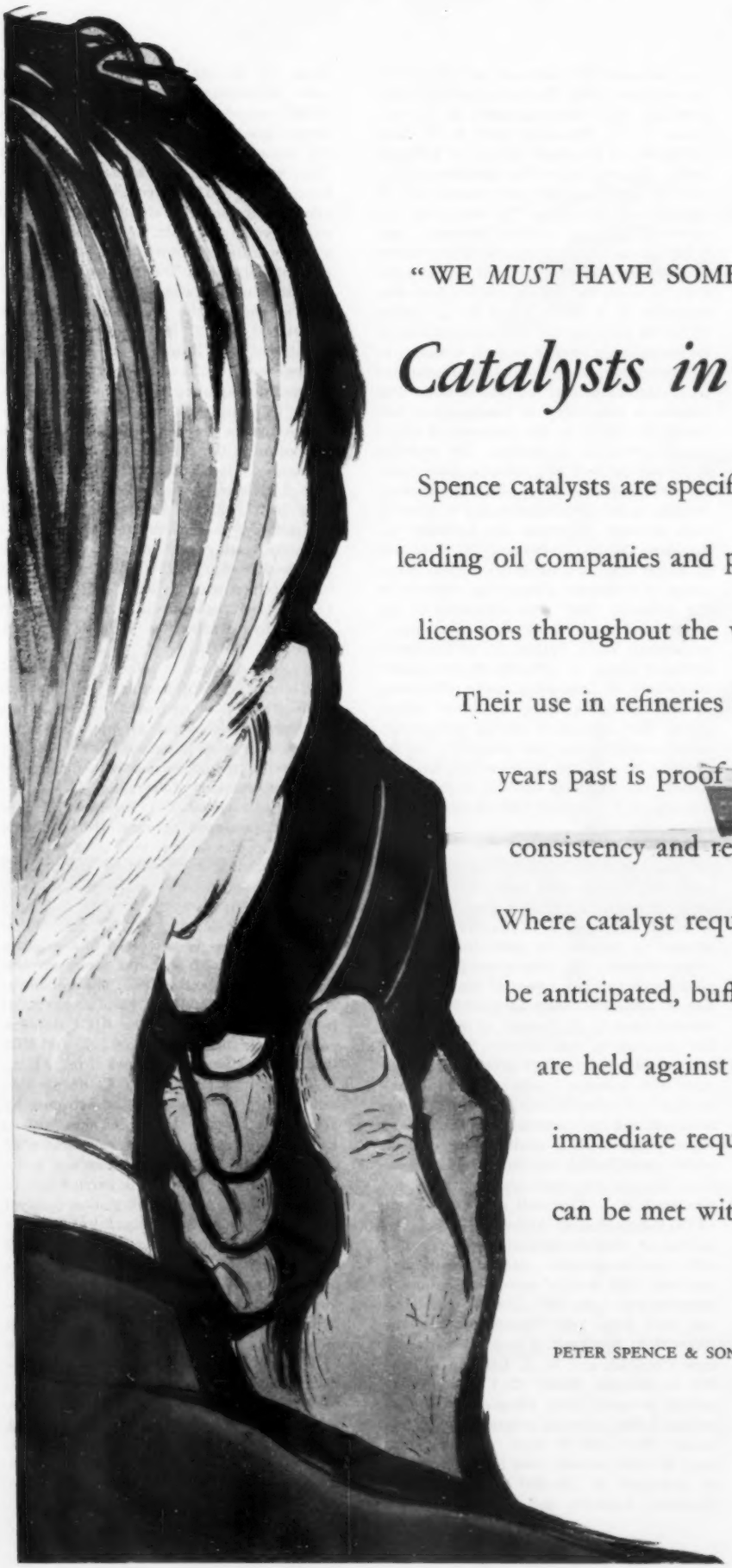
Some sixteen patents are considered in this section dealing with the separation and purification of aromatic hydrocarbons. R. A. Findlay of Phillips Petroleum Co. in 2,758,141 separates benzene and xylenes from difficultly separable paraffins by extraction with SO_2. The SO_2 extract is flashed to remove part of the SO_2. The resulting decrease in temperature precipitates the paraffins which are then separated. The aromatic rich liquid phase is further chilled to precipitate aromatic crystals which are then filtered off. In a different type of solvent extraction, A. P. Lien and D. A. McCaulay (2,739,992 to Standard Oil Co. of Indiana) claim to extract ethyl benzene from its mixture with xylenes. The mixture is contacted at 30°-160°F with a solution of silver flouride (AgF) in liquid HF; the AgF should be present in amounts between ¼-⅓ mile per mole of xylene in the feed, the HF is used in amounts between 10-1500 vol.%. The extract phase contains HF, AgF, and C_8 aromatic hydrocarbons in which the xylene/ethyl benzene ratio is greater than that in the feed. Conversely, this ratio in the raffinate is less than that of the feed. McCaulay and Lien in 2,766,305 separate a C_8 aromatic feed into xylene and ethyl xylene. The charge mixture is contacted with 1-5 moles of HF_3 per mole of xylene and 2-50 moles of liquid HF per mole of aromatic at 160°F for a time sufficient to attain equilibrium. The ethyl xylene formed is essentially the 1,3,5 isomer. In 2,768,986 (C. E. Johnson, A. P. Lien, and D. A. McCaulay to Standard Oil of Indiana) aromatics are separated from saturated non-aromatics by counter-current contact under anhydrous conditions with an alkane sulfonic acid (the alkyl group should contain 1-9 carbons) and a silver sulfate or alkyl sulfonate. The temperature of extraction should be between 0-150°C with acid concentrations of 50-120 vol.% based on hydrocarbon feed and silver salt concentrations of at least one gram atom per mole of aromatics. The aromatics are then dissolved in the acid phase. H. W. Grote of Universal Oil Products Co. (2,770,663) produces an aromatic concentrate from a heavy reformate fraction. This fraction is extracted with aqueous poly oxy-polyalkylene glycol to form an aromatic extract containing minor amounts of heavy paraffins. The extract is contacted with the light paraffinic reformate fraction in amounts greater than necessary to displace the heavy paraffins from the extract. The light paraffins can then be fractioned out and recycled. In 2,770,664 (L. H. Horsley, V. S. Morelle, N. Poffenberger to Dow Chemical Co.) benzene or other aromatics are extracted from a reformate by multistage counterflow extraction with diethylene glycol containing 0.5-10 wt.% of water. A. W. Francis of Socony Mobil Oil Co. (2,776,327) uses as a selective solvent for aromatics a mixture of 10-50 wt.% of sulfuric acid with 90-50 wt.% of a dialkyl sulfate. The sulfuric acid concentration should be between 103-107% H_2SO_4 and the alkyl sulfate should contain up to about four carbons per molecule.

A. C. Nixon and C. H. Deal, Jr. (2,768,-220,-221,-222 to Shell Development Co.) separate p-xylene from its mixture with m-xylene and ethyl benzene by contacting the mixture with antimony tribromide ($SbBr_3$) such that the $SbBr_3/C_8$ aromatic hydrocarbon ratio lies within a region of the phase diagram in which a solid complex of $SbBr_3$-hydrocarbon will precipitate on cooling. The solid complex will form preferentially with p-xylene. In a related patent (2,793,240 to Union Oil Co.) W. D. Schaeffer and C. B. Scott concentrate a p-dialkyl benzene from its mixtures with isomers by dissolving an antimony trihalide in the mixture. The temperature is lowered until a solid forms in which the p-isomer is concentrated. The solid is separated and dissolved in aqueous HCl or HBr to liberate the hydrocarbon.

An interesting separation process is the subject of the next three patents. In 2,769,-851, W. D. Schaeffer of Union Oil Co. proposes a process for resolving a mixture of C_8 aromatics by contacting the mixture with a clathration agent consisting of a p-amino triphenyl methane. In the p-amino triphenyl methane the two other p-positions are taken up by hydrogen, $-NH_2$, or $-OH$. Solid complexes of o- and m-xylenes are selectively formed from their mixture with p-xylene. W. D. Schaeffer and W. S. Dorsey (2,798,102 to Union Oil Co.) recover aromatic hydrocarbons from their solid clathrates with Werner complexes by steam stripping. In order to recover the Werner complex undecomposed the steam should contain an equilibrium proportion of the nitrogen base of the complex. In a companion patent (2,798,103 to Union Oil Co.) W. D. Schaeffer and J. D. Wordie claim to resolve aromatic hydrocarbon mixtures by clathration with a solid Werner complex. The Werner complex is composed of a metal salt coordinated with four moles of a heterocyclic nitrogen base. The contacting takes place in the presence of an excess of

Fig. 2: US Patent 2,767,231, Dated October 16, 1956, Granted to R. M. Kennedy et al.





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the base and at least one of the hydrocarbons is selectively absorbed into the crystal structure of the complex.

R. B. Bennett, W. T. Hunt, J. M. Powers, and R. A. Speed of Esso Research and Engineering Co. in 2,766,310 propose a method for recovering durene from a feed stock containing 5-40% durene. The charge is dissolved in a normally gaseous liquid hydrocarbon, and the solution is chilled to −40°C to −80°C. A readily filterable slurry is obtained and the resulting filter cake contains around 50% durene. By allowing the crystals to grow, about 95% durene can be obtained.

According to C. J. Schmidle (2,775,630 to Rohm and Haas Co.) α-methyl styrenes are separated from the corresponding isopropyl benzenes by reacting the styrene with formaldehyde and a basic nitrogen compound having hydrogen available on the nitrogen. The reaction is carried out in the presence of HC1 as a catalyst, and an acid salt of the nitrogen base is formed which can be separated from the isopropyl benzene.

Reactions of Aromatic Hydrocarbons

The first reaction discussed here is *alkylation* of aromatics with some ten patents being considered. In 2,758,140 (V. N. Ipatieff, H. Pines, and B. Kvetinskas of Universal Oil Products Co.) an olefin is reacted with an aromatic having a side chain with α-hydrogens to give side chain alkylation. The reaction is carried out in the absence of a catalyst at pressures above 1000 psig, temperatures in the range of 350°-500°C, and space rates from 0.1-10 volumes per volume per hour. The ratio of aromatic to unsaturate should be above 1.0. L. Schmerling in 2,759,028 (Universal Oil Products Co.) produces primary alkyl aromatics by reacting a 1,1-dihalide containing a quaternary carbon with an alkylatable aromatic hydrocarbon in the presence of a Friedel-Crafts catalyst. In 2,759,029 the reaction is also carried out in the presence of a saturated hydrocarbon containing a tertiary carbon to give a monoalkyl benzene as chief product. In this same series of patents, Schmerling in 2,759,030 uses a halo-alkene and a tertiary, saturated hydrocarbon to give a monoalkylated benzene by hydrogen transfer. G. L. Hervert and H. S. Block (2,761,000 to Universal Oil Products Co.) propose to obtain separate straight and branched chain alkylate products by using a mixed olefin feed as alkylating agent. The olefin feed, containing straight and branched chain olefins, is contacted with 80-95% sulfuric acid. The extract contains branched olefins and H_2SO_4; aromatics are added to this mixture which is subjected to alkylating conditions to produce branched chain alkylates. Stronger H_2SO_4 and aromatics are added to the raffinate to give straight chain alkylate. In 2,763,702 (to Dow Chemical Co.) J. L. Amos and K. E. Coulter prepare m- and p-methyl styrenes by ethylating toluene and distilling out the m- and p-methyl toluenes. Unreacted toluene, o-ethyl toluene, and polyethyl toluenes are recycled to the ethylation step. The o- and p-ethyl toluenes are then dehydrogenated to the styrenes. D. A. McCaulay and A. P. Lien (2,766,307, to Standard Oil Co. of Indiana) make 1,3,5 ethyl xylene by dissolving xylene in 3-50 moles of HF and enough BF_3 to complex all the xylene. To this mixture is added ethylene in amounts between 1 and 1/20 mole per mole of xylene. Temperature is maintained below 135°C for a time sufficient to attain the desired ethyl xylene distribution. D. A. Skinner and W. L. Wasley (2,777,007 to Union Oil Co.) claim a process for propylating toluene in such a way as to maximize the p-cymene yield and minimize polypropylation and polymerization. The toluene is propylated at temperatures between 20°-110°C in the presence of phosphorus pentoxide as catalyst. The reaction is carried out to 5-20% toluene conversion; unreacted toluene is recycled and a cymene fraction is recovered containing at least 40 mole percent p-cymene. In 2,780,660 (to Standard Oil Co. of Indiana) E. Field and M. Feller claim a process for nuclear alkylation of aromatics comprising reaction of the aromatic feed with ethylene in the presence of the hydried of an alkali metal as catalyst. W. G. Toland, Jr. of California Research Corp. in 2,793,239 effects nuclear alkylation of aromatics with alkylating agents containing three or more carbon atoms. The reaction is carried out at elevated temperatures and pressures in the presence of a dilute, aqueous solution of a strong acid. The acid content of this solution should be between 0.05-10 weight percent.

The reverse of the alkylation reaction discussed in the previous paragraph is dealkylation. For various reasons it is sometimes of advantage to dealkylate and alkyl aromatic, for example, to convert undesired toluene to benzene or methylnaphthalene to naphthalene. The next seven patents are all devoted to some aspect of the dealkylation of alkyl aromatics. In 2,767,231, R. M. Kennedy and C. K. Donnell of the Sun Oil Co. propose to concentrate dialkyl aromatics with one tertiary group from mixtures with isomeric trialkyl aromatics containing the same tertiary group. This is accomplished by contacting the mixture in vapor phase with a dealkylating catalyst under dealkylating conditions. Not more than 91% of the total aromatics are dealkylated. H. L. Coonradt and B. W. Rope (2,750,432 to Socony Mobile Oil Co.) demethylate methylnaphthalenes by contact with a silica-alumina catalyst, containing between 5-20 weight percent alumina, at temperatures from 900°-1200°F, with contact time from 1-60 seconds, and in the presence of hydrogen at atmospheric pressure. Coonradt and W. K. Leamon (2,786,876 to Socony Mobil Co.) demethylate methyl benzenes over silica-alumina containing 5-20% alumina at temperatures between 1050°-1200°F with contact times from 40-1000 seconds, and in the presence of hydrogen at 100-500 psig. Similarly, Coonradt, Leamon, and Rope (2,795,633) claim to demethylate methyl aromatics over silica-alumina at 1000°-1200°F for 2-1000 seconds, and in the presence of hydrogen gas. Coonradt and Leamon in 2,773,917 dementhylate aromatics by contacting them with chromia-alumina catalyst, containing from 4-12% chromia, or a chromia catalyst cogelled with alumina having 18-80 mole/percent chromia, or a molybdena-alumina catalyst containing 5-20 weight percent molybdena. The temperature should be maintained between 1000-1150°F for 40-1000 seconds in the presence of hydrogen at 50-2000 psig. E. S. Hoffman and H. G. Schutze of Esso Research and Engineering propose in 2,768,219 an improvement to the thermal dealkylation of aromatic hydrocarbons. This improvement comprises removing peroxides, oxygen, and ash from the feed prior to the thermal reaction. Such a procedure, it is claimed, reduces the formation of undesirable deposits in the reaction zone. In 2,776,326, A. Schneider of Sun Oil Co. proposes to demethylate toluene thermally by heating the hydrocarbon at 75-700 psig. to 500°-800°C. The toluene should be in admixture with an acyclic hydrocarbon (having 2-5 carbons) in a mole ratio of acyclic hydrocarbon to toluene of 0.5/1 to 20/1.

A reaction which is related to dealkylation is that of disproportionation, in which an alkyl group, or hydrogen, instead of being liberated from the aromatic is transferred to another aromatic. The following six patents are concerned with disproportionation reactions of aromatics. G. L. Hervert of Universal Oil Products Co. in 2,739,991 produces benzene from toluene by reacting the toluene with another alkylatable aromatic hydrocarbon. This is carried out under methyl transfer conditions in the presence of an acidic catalyst. In 2,739,993 (A. Schneider and W. K. Conn to Sun Oil Co.) toluene is converted to a mixture of naphthenes with less than seven carbons /mole, benzene, and xylene. The toluene is contacted with $AlCl_3$, HC1 and an excess of hydrogen at 50°-300°C. The $AlCl_3$/toluene ratio is maintained between 0.1-10 and HC1 is kept at 1-10 weight percent of the $AlCl_3$. M. S. Schaltter (2,759,984 to California Research Corp.) makes alkylated benzenes by reacting a tertiary butyl benzene with a hydrocarbon comprising an iso-paraffin or a cycloparaffin containing at least one tertiary carbon. The reaction is carried out in the presence of a liquid alkylation catalyst under alkylation conditions. Ethyl benzene is disproportionated according to 2,773,109 (A. P. Lien and D. A. McCaulay to Standard Oil Co. of Indiana). The feed is contacted with at least three moles of anhydrous HF and 0.4 mole of BF_3 per mole of ethyl benzene at temperatures above 75°C for at least one half hour. The product consists of benzene, ethyl benzene, 1,3-diethyl benzene, and 1,3,5-triethyl benzene, with the triethyl benzene yield being greater than that of the diethyl benzene. McCaulay and Lien in 2,795,632 also produce m-secondary alkyl toluenes by con-

(Continued on page 76)

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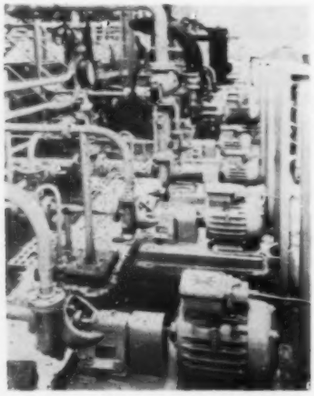
Chemical & Petroleum Engineering Exhibition

(Continued from page 49)

hibiting a selection of valves and fittings—including bronze-gate, globe-and-check, cast-iron and cast-steel valves and fittings. Of special interest to the petroleum industry will be the christmas-tree assemblies and Newman-McEvoy automatic self-sealing conduit gate valves for production and pipeline services. An electrically operated example of the latter is being featured.



Sigmund Pumps Ltd.: Battery of B-N chemical pumps.

The display of Sigmund Pumps Ltd. is to comprise representative pumps from their ranges for use in the chemical and oil industries—fields in which they have long been recognized as specialists, having built pumping plants for every phase of chemical and refinery processes. Included in the display will be the B-N stainless-steel chemical pump, which can alternatively be had in Paralloy, zinc-free bronze, or all-iron construction. The range of nine pumps covers outputs up to 250 Imperial gallons a minute, and heads up to 350 ft, while using only two sizes of support frames and bearing housings—thus permitting speedy interchange of units with consequent economy. Also included are a range of heavy-duty single-stage chemical pumps, available in a wide variety of materials; a range of vertical glandless acid pumps; and a standard single-stage single-suction high-temperature process pump incorporating all the features demanded by operators to meet current refinery practice. Throughout the exhibition, a technical staff will be available to discuss every application of the company's products.

Negretti & Zambra Ltd. will be showing a range of instruments comprising automatic controllers of the nonindicating, indicating, and recording types; air-operated program controllers, electrical controllers, contact and mercury switches. Among the many types of thermometer will be seen glass, bi-metallic-recording, mercury-in-steel indicating and recording instruments, as well as thermocouple and resistance-element type of electrical thermometers. The new "Mini-Vi" pyrometer, a miniature instrument incorporating antivibration mounting, will also be shown.

The exhibit of F. Perkins Ltd., Peterborough, will comprise a comprehensive range of industrial diesel engines for such applications as cranes, drilling rigs, pumps, welding and generating sets, fork-lift trucks, excavators, etc. The main features of all these engines are press-button cold-starting, compactness, accessibility, and low fuel consumption. The engines to be seen at the exhibition are:

L4(I) Bearer-mounted diesel engine for industrial applications developing 62 bhp at 2,000 rpm with Brockhouse torque converter and two-speed transmission.

P6(I) Bearer-mounted diesel engine for fork-lift trucks, mobile cranes, straddle carriers, etc.; intermittent ratings up to 83 bhp at 2,000 rpm.

R6(1) Power-pack designed for industrial applications; ratings up to 67 bhp at 1,800 rpm.

P3(I)/144 Power unit, rated to develop up to 28 bhp at 1,800 rpm.

F. Perkin Ltd. P6(I) industrial-type diesel engine.

Serck Radiators Ltd. fuel-oil heater assembly, showing removable tube stack and steam cover.

From the wide range of heat-transfer equipment manufactured by the company, Serck Radiators Ltd., of Birmingham, are showing a number of primary and secondary surface heat exchangers and oil-coolers for such applications as diesel, petrol, and oil-engine jacket-water and lubricating-oil hydraulic couplings, gearbox oil, chemical and petroleum process plant, and for liquid and gas cooling. Units are available for handling anything from a few gallons a minute to 40,000 gal an hour; also for liquid or gas under any pressure and up to temperatures of 900 F. A special unit being shown is a combined oil and water cooler for an oil-well drilling package set. An ⅛ scale model of the Serck "A" type of tube-fin air-blast heat exchanger for temperate or tropical conditions will be on view. Other exhibits include a hydrostatic fan drive for conditions involving appreciable variation and sudden changes in ambient-air temperatures, a guided-flow furnace fuel-oil heater occupying about a quarter of the space of any existing heater, and a range of condenser tubes in a variety of materials for use as heat exchangers for many different purposes.

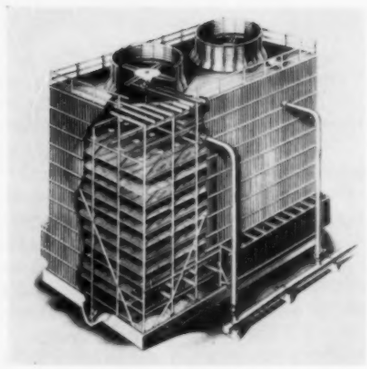
Yorkshire Imperial Metals Ltd. represents the merging of The Yorkshire Copper Works Ltd. and the Metals Division of Imperial Chemical Industries. Their exhibits will cover solid-drawn tubes for process heat exchangers, coolers, condensers, and fresh-water evaporating plant, together with other tubular heat-exchange equipment in a wide range of special nonferrous alloys. Also on display will be tubes and fittings for domestic and general engineering services, and plastic tubes in standard and natural polyethylene.

Of particular interest to the oil industry is the range of Record hand tools being shown by C. & J. Hampton Ltd., Sheffield 2, England, which—in addition to the well known pipe wrenches—include vises, welding clamps, cutters, and chain wrenches.

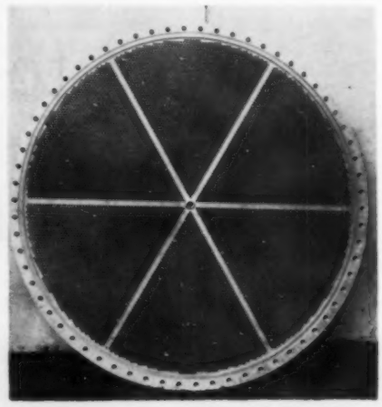
It is of interest that the Oil Well Supply Co. Ltd.—which will be exhibiting a variety of pumps for use in the oil fields—is the oldest concern of this nature in England, the office having been opened 48 years ago in response to a pressing demand for American drilling and production machinery for the world's oil fields. The company is the sole distributor of "Oilwell"-British machinery and equipment, manufactured under license by Armstrong Whitworth (Metal Industries) Ltd.

Head, Wrightson Processes Ltd.—who act as consultants and contractors to the petroleum, chemical, petrochemical, and nuclear industries—will be showing, as their main exhibit, a model of the "Dido" heavy-water research reactor which they have supplied to the United Kingdom Atomic Energy Authority. Such a reactor has already been supplied also to the Australian Atomic Energy Commission, and is now almost completely erected at Lucas Heights, near Sydney. A similar reactor for Land-Nordhein-Westfallen, West Germany, constitutes the sixth reactor order and the third for export. A reactor of the Pluto type is on order for Denmark. Head-Wrightson claim to be the largest exporters of nuclear research reactors in Europe, the total value of which—including laboratory buildings, cooling equipment, and ancillary installations—is approximately £2,000,000.

T. M. Birkett, Billington & Newton Ltd., the nonferrous founders and engineers, specialize in high tensile aluminum-bronze castings, cast pressure vessels, channels and covers in aluminum-bronze, manganese-bronze, and high-duty iron for the chemical and petroleum industries, as well as centrifugally cast gear-wheel blanks, boiler mountings, valves, and all types of fittings for locomotives. An illustration herewith shows a fully-machined bronze tube plate for a condenser—with overall diameter 5 ft 7 in., and 11,000 drilled holes.



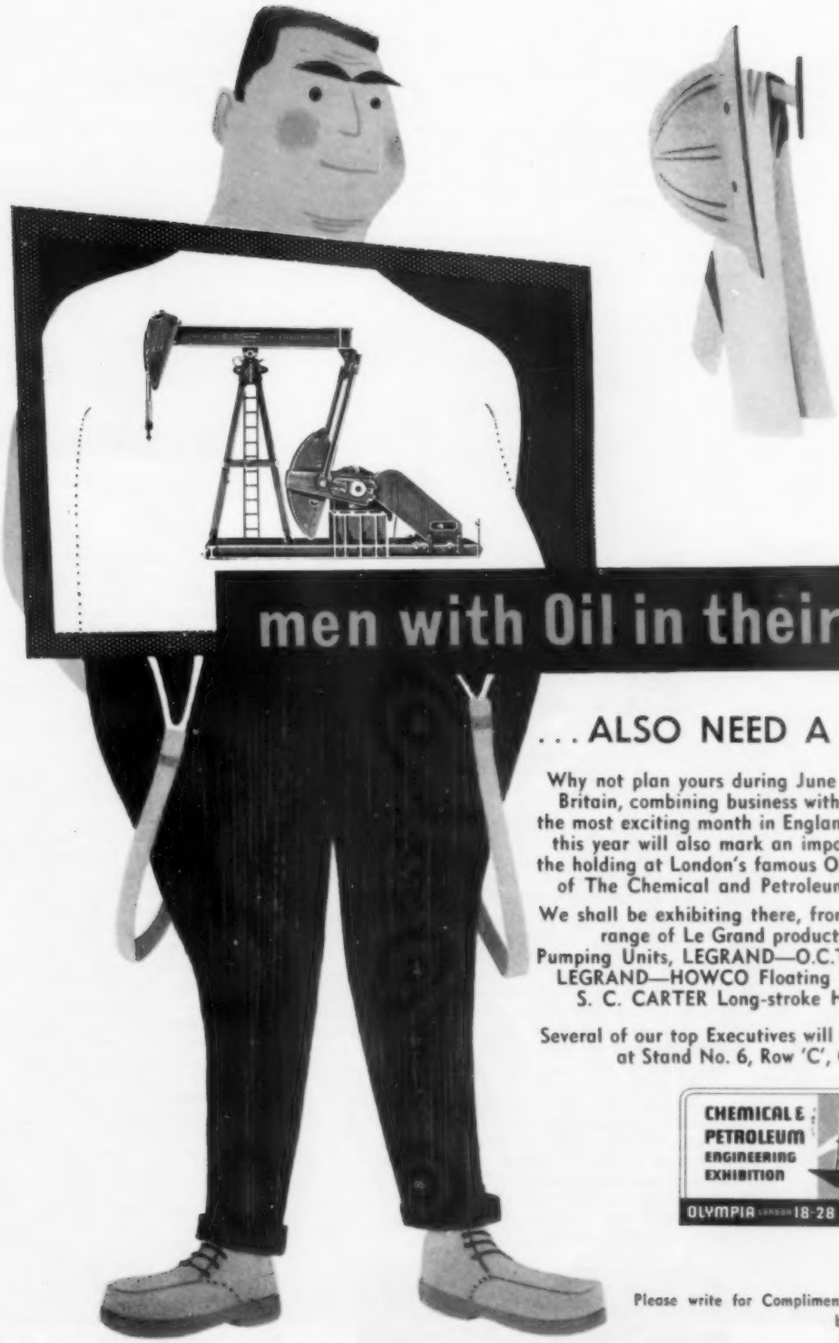
Artist's drawing of the new design of counterflow induced-draft cooling tower—manufactured by Head Wrightson Processes Ltd.



Fully-machined manganese-bronze tube plate for condensers 5 ft 7 in. in overall diameter, with 11,000 drilled holes—manufactured by T. M. Birkett, Billington & Newton Ltd.

In a fully comprehensive display the Consolidated Pneumatic Tool Co. Ltd. will be exhibiting some entirely new lines of compressed-air plant and a selection from an extensive range of power tools. Of main interest to the oil industry will be the Lagonda tube-cleaning equipment, to deal with both straight and curved tubes from ⅝ in. to 6 in. in diameter. The class PO-44 portable compressor—powered by a Rolls Royce diesel engine, and built specifically for the oil industry—is employed in field service for pressurizing or the "rocking" of wells. Pneumatic and electric power tools for every class of work will be seen actually in use. Special mention must be made of the Rippador saw, especially designed for air rescue work, which has stimulated much interest among airline authorities.

Typical Emco Wheaton rail loading installation, in Germany, using counterweighted loading arms.



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We shall be exhibiting there, from 18th until 28th June, a range of Le Grand products, including the 'L' Series Pumping Units, LEGRAND—O.C.T. Well-head Equipment, LEGRAND—HOWCO Floating Equipment, LEGRAND—S. C. CARTER Long-stroke Hydraulic Pumping Units.

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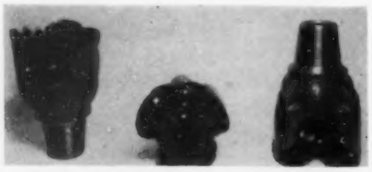
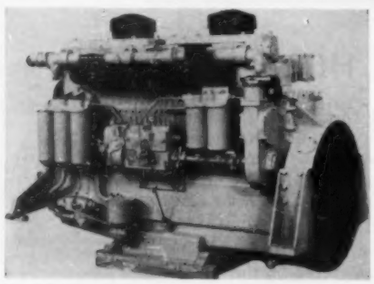
Established less than 10 years ago in the United Kingdom, the Emco Brass Manufacturing Co. Ltd. (a branch of Emco Ltd. of Canada) produces and sells the Emco Wheatson range of petroleum and oil-marketing equipment which is primarily concerned with fluid handling in the retailing and marketing of petroleum and oil. The products are made to a common standard, and are interchangeable—insuring an efficient worldwide replacement service. At the exhibition, there will be seen a B690 series sliding-tube loading assembly—together with a model of a truck tank showing not only methods of loading, but also the various Emco fluid-handling accessories. From the storage-tank range will be seen a working model of the floating suction unit, with automatic tank gages and allied fittings.



Some of the many sizes and types of Hughes Tool Co. Tricone rock bits.

An accompanying illustration shows one of the many sizes and types of Hughes Tricone rock bits, viz., the type W7R-J, a product of the Hughes Tool Co. Ltd., for operating in a very hard, abrasive formation. Several varieties of rock bits will be seen in the range 4¼-in. to 12¼-in., including jet and conventional bits. Samples of bottom-hole patterns drilled by various designs of rock bits in stone blocks will be shown, as well as cutaway sectional rocks bits and the various components and stages of assembly up to the finished products.



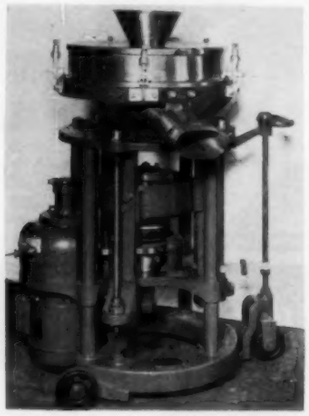
Type 6QA 6-cylinder 100- to 350-hp W. H. Dorman & Co. industrial diesel engine.

W. H. Dorman & Co. Ltd., whose diesel engines are known throughout the world, will be showing industrial diesels from 20- to 350-hp; marine diesel engines from 30- to 230-hp; and diesel-electric generating sets from 13- to 140-kw. The complete "L" range of 2- to 8-cylinder engines will be on view, together with a 6-K engine in power-pack form, a 6KUM marine unit, and the new 6QA 6-cylinder 100- to 350-hp industrial type, illustrated herein; also the 6QA/M marine engine. Turbo-charged models will be exhibited for the first time—this equipment being seen with the 6QA industrial engine.

Simmons & Hawker skid-mounted mud-pumping and recovery manifold, assembled and ready for dispatch at Feltham Works.

Beginning more than 35 years ago with the curb-side gasoline pump, Simmons & Hawker Ltd. have been manufacturing filling machines, pipe fittings, small tanks, and mobile fuelers for the expanding petroleum distribution trade in the United Kingdom. Many pioneer installations for refueling aircraft were also installed. During the war, experience so gained was invaluable in such unusual tasks as the Pluto installations. Since the war, emphasis has been on the production of pipe work, vessels, and heat exchangers to the rigid requirements of the oil and chemical industries. In addition to this specialized work, the company has machine and structural shops enabling a complete service to be given to these industries—providing everything from a welding reducer to a complete fueling installation or refinery sub-unit. An accompanying illustration shows skid-mounted mud-pumping and recovery manifold assembly ready for dispatch.

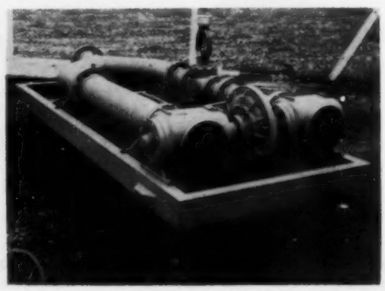
George Angus & Co. Ltd. are to exhibit a variety of fire-fighting equipment, particularly that designed for the protection of chemical and petroleum installations. The reinforced rubber-lined hose is standard equipment for many companies at home and overseas, both ashore and afloat. A special process of Plastiproofing is used to give extra protection against weather, salt water, acids, alkalis, etc. The complete range of dry-powder chemical extinguishers will be on view, from the 5-lb to the 350-lb models which have not been previously exhibited. Even larger extinguishers are made to suit customers' requirements.



Russell Constructions Ltd. variable-speed sieving and straining unit designed to give super-production through ultra-fine meshes.

Russell Constructions Ltd. will be demonstrating their most recent developments in the sieving and straining equipment. High-frequency gyratory vibration—which is the basis of operation of these machines—enables extremely high outputs to be attained. The high-speed strainer, with a screen area less than 2½ sq ft, can strain materials at the rate of 1,200 gal per hour; while an improved model of the well known separator has a capacity up to 15,000 gal per hour, is self-cleaning, and automatically rejects oversize material. This machine has been most successfully applied to the straining of oil-based mud on drilling rigs.

Firth Vickers Stainless Steels Ltd., the largest company of its kind in Europe, specializes in one one particular line—producing only stainless, heat- and corrosion-resisting steels. Accordingly, the firm's exhibit will consist of stainless-steel sheets in a variety of finishes—together with stainless-steel bars and a selection of static, centri-spun, and precision castings. Full technical particulars of all types of steels which the company makes will, of course, be available at the stand.



Fisher Governor Co. Ltd. type 431 blending unit.

The Fisher Governor Co. Ltd. is exhibiting a representative range of its standard products, which will include diaphragm motor-operated valves, pressure regulators, and level control equipment. Two new types of electrohydraulic valve actuators —not previously exhibited—will be seen. Recent trends towards electrical control circuits have created a need for final control elements capable of using the greater transmission speed; these actuators constitute self-contained electrically-operated valve operators ideal for this purpose. They afford high performance without requiring electronic amplification. The Wizard II controller has been developed to meet the requirements of the chemical and process industries without materially sacrificing the compactness and simplicity of earlier types. A blending unit for the in-line blending of intermediate grades of fuel oil is also to be shown.

Working model of a LeGrand Rochester 10/42-cc MK 14 pumping unit.

Oil-field equipment will be the main theme of the exhibit of LeGrand Rochester Ltd.—with special emphasis on pumping units, well-head and cementing equipment. Of particular interest will be a perfect working scale model of a LeGrand pumping unit in action, enabling spectators to see oil actually being pumped from the producing horizon and arriving at the surface. Much ancilliary equipment will also be on view. Following the company's recent association with the Davey Compressor Co., their products are being illustrated by a series of photographs.

The presentation on a single stand of "Caposite" asbestos and "Rocksil" rock-wool thermal insulation materials; "Vermiculux" fireproofing concrete; "Asbestolux" building board, together with brake and clutch linings, asbestos textiles and cements, packings, jointings and millboard—all manufactured by The Cape Asbestos Co. Ltd.—will give visitors a clear idea of the comprehensive service which this company is capable of offering to the oil industry. The "Rocksil" rigid pipe sections provide inexpensive pipeline insulation for every type of domestic, industrial, and marine requirement with a temperature range up to 600 F. Apart from manufacture, the company's contracts department undertakes the fitting of insulation for all such purposes.

The main contribution of Lake Elliot Ltd. to the chemical and petroleum industries is the production of furnace fittings made under license from the W-K-M Manufacturing Co. Inc., of Houston, Texas. The manufacturing technique has been built up over the past 12 years, and strict quality control has been introduced. The Millenium-Key fittings are designed both to suit operating conditions and the corrosion-erosion characteristics of the raw materials being processed. The company also supplies a large variety of castings in high-quality carbon, alloy, and stainless steel for use in the oil industry.

The W.K.M. Valve Co. (Britain) Ltd. was formed in London in 1953 to promote the manufacture and sale of the W.K.M. valve range in the sterling area. Well-head valves are manufactured by the National Steel Foundry (1914) Ltd. of Kirkland Works, Leven, Fife; pipeline valves up to 33 in. in diameter.

As founder members of the Council of British Manufacturers of Petroleum Equipment, The United Steel Companies Ltd. are showing typical examples of their steel products supplied to the chemical and petroleum industries.

Silver Fox stainless steel will be represented in a variety of applications—including a half-coil jacketed vessel, a miniature Rosenblad heat exchanger, and a Calandria. Samuel Fox & Co. Ltd., a United Steel subsidiary, has pioneered the development of stainless-steel curtain walling in Britain, and one entire wall of the exhibition stand will be constructed in this material. Forged-steel rings, made by the company's Steel, Peech and Tozer branch, are being shown—together with a forged tube round as supplied to the tube makers

(Continued on page 78)

"The economy of the United States is firmly based on oil, which now supplies some 44 per cent of our total energy requirements. Our mechanized agriculture, modern methods of transportation and expanding industrial system are so dependent upon oil that it has become an integral part of our social and economic life."

—M. J. Rathbone, President, Standard Oil Company (New Jersey)

Esso

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

(Continued from page 70)

tacting toluene and a secondary alkyl benzene with HF and BF_3. The toluene/secondary alkyl group ratio should be maintained between 1-3, at least 50 moles of liquid HF should be used per mole of total aromatic, and at least one mole of BF_3 per mole of secondary alkyl group. The reaction temperature is from −40° to 40°C, and sufficient time should be allowed for formation of the m-secondary alkyl toluene. I. Bergsteinsson (2,798,104 to Union Oil Co.) claims a process for removing ethyl benzene from its mixture with xylenes. The mixture is subjected to a temperature between 50°-260°C in the presence of an isomerization catalyst and a fused ring aromatic hydrocarbon. This last is present in molar excess relative to the ethyl benzene. The ethyl groups are selectively transferred to the fused ring compound and xylene is recovered by distillation. The isomerization catalyst used is a heat stable mineral acid or a Friedel-Crafts catalyst.

The two patents next discussed are concerned with isomerization of xylenes. D. E. Nicholson and R. H. Perry, Jr., (2,775,628 to Esso Research and Engineering Co.) equilibrate xylene mixtures deficient in p-xylene, at the same time minimizing cracking and disproportionation. Their method comprises contacting the mixture with a silica-alumina catalyst, having a surface area between 50-80 m^2/g, in the presence of hydrogen. Conditions for the reaction are 900°-1000°F, 200-400 psig, space rates from 1-3 volumes per catalyst volume per hour, and hydrogen/oil ratio between 3-5. In 2,784,241, M. M. Holm of the California Research Corp. proposes to equilibrate a non-equilibrium xylene mixture by contacting the mixture with a hydrogenation-dehydrogenation catalyst under conditions of temperature, pressure, and hydrogen partial pressure which permit a minor amount of naphthene to exist in equilibrium with the xylenes.

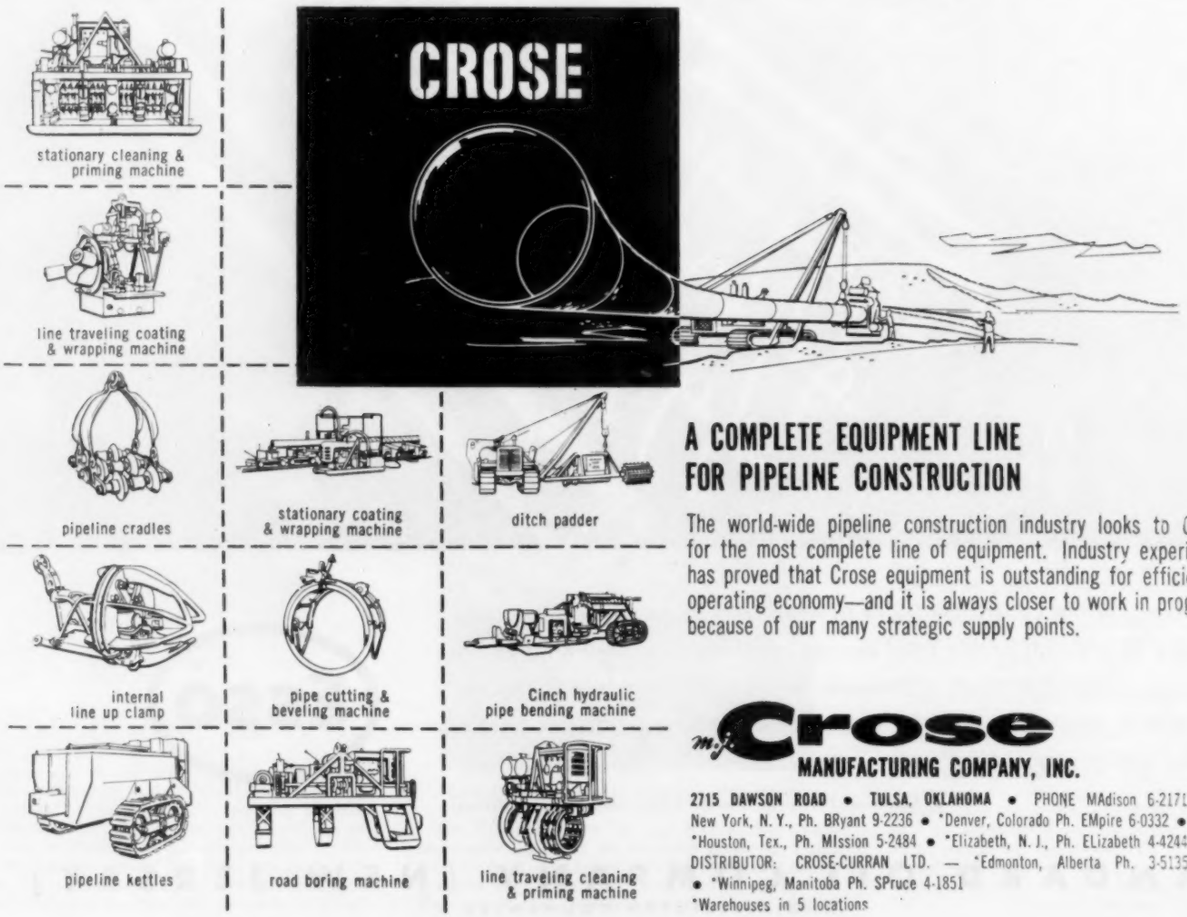
The final three patents considered in this review deal with some miscellaneous reactions of aromatic hydrocarbons. According to L. S. Kassel (2,755,317 to Universal Oil Products Co.) cyclohexane can be manufactured by contacting a mixture of benzene, hydrogen, and cyclohexane with a hydrogenation catalyst in several hydrogenating zones. The effluent from each zone, except the last, is cooled to 325°-400°F by heat exchange and admixture of benzene. In 2,761,886 (C. E. Frank and J. S. Swinehart of National Distillers Products Corp.) styrene is coupled with an alkyl aromatic. The reaction is carried out by dispersing an alkali metal in the aromatic at 60°-200°C and adding styrene at a uniform rate which is less than 0.25 mole of styrene per mole of alkali metal per hour. Indene is produced according to E. J. Hoffman and A. M. Souby of Esso Research and Engineering Co. (2,763,701) by subjecting an indane containing fraction to temperatures from 1100°-1400°F, pressures from 400-1000 psig for residence times of the order of 3-120 seconds. The reaction takes place in the presence of 2000-10,000 cubic feet of hydrogen per barrel of feed. END

Herb E. Maland

MALAND 1958 NOMADS CHAIRMAN

Herb E. Maland, vice president of R. J. Eiche & Associates, New York, has been elected 1958 chairman of the NOMADS National Board of Regents—top office in the national society. A native Californian, he has worked on the Pacific Coast for several oil-field equipment companies in design, development, and sales.

Maurice F. Delano, Jr., of R. S. Stokvis & Sons Inc., becomes secretary-treasurer. Both men have been active in the New York Nomads chapter.



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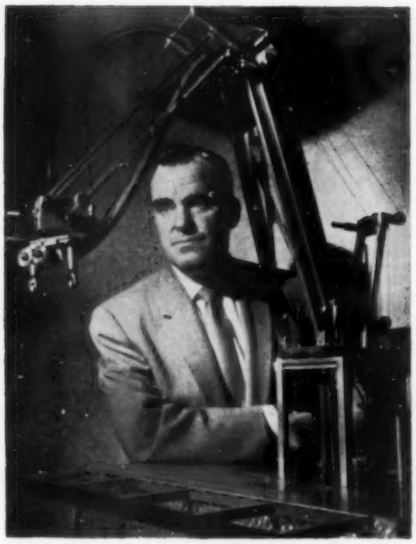


William Mulvihill Jr., marketing manager of US Rubber Co.'s international division, demonstrates model of new automatic rig for Asiatic Petroleum Co., for connecting oil hose directly to a tanker's manifold. An operator at the controls of a full-scale rig—first of which is now under construction—will be able to steer two 12-in. hose lines to the manifold in seconds.

Automatic Rig Cuts Tanker Loading Time

Asiatic Petroleum Co. and United States Rubber Co. have concluded an agreement to build an automatic rig, developed by the rubber company, for conveying oil hose from dockside to ship's manifold. Based on the operating principle of a pantagraph, the rig will be hydraulically-operated by one man at a push-button control panel. Present methods of connecting rubber oil hose frequently require the use of 8- to 10-man crews—taking from an 1½ to 2 hours for the job. With the new rig, the operator can steer two 12-in. oil hose lines directly to the manifold in 3 min. Thus, the rig promises "faster turnaround" for tankers, whose cost consumption at dock is estimated at $2,500 per hour. In addition, oil hose life will be greatly increased, because the hose will be protected by the rig itself. The rig for Asiatic is being built by Duncor Associates, Newark, N. J., to be in operation at Bayonne, N. J. late in April.

D. T. Staples

G. F. Getty II

Tidewater's Executive Changes

David T. Staples, formerly president, has been elected chairman for Tidewater Oil Co., New York. Succeeding him as president is George F. Getty II, who advances from his previous post as vice president and general manager of the company's eastern division.

Mr. Getty entered the oil industry in 1947 as an independent oil operator. He served as manager of the Saudi Arabian division of Pacific Western Oil Corp. (now Getty Oil Co.) in 1949 and 1950; manager of its mid continent division in 1952, and executive vice president and director in 1955. He was first elected to the Tidewater board two years ago, at which time he became vice president and general manager of its eastern division.

Two new directors have been elected to Tidewater's board: Chester A. Rude, vice chairman of Security-First National Bank, Los Angeles; and Theodore Weicker, Jr., general partner, E. F. Hutton & Co., New York.

J. G. Jimenez, formerly eastern division marketing manager, has been elected a vice president and appointed general manager of Tidewater's eastern division operations—replacing George F. Getty II. John W. Gendron, former administrative assistant to the president in San Francisco, has been named eastern division manager.

Mr. Jimenez joined Tidewater in 1930. He has held a number of marketing executive positions, and became division marketing manager in 1956. Mr. Gendron joined the company in 1946. After successive rises, he was appointed administrative assistant to the president last year.

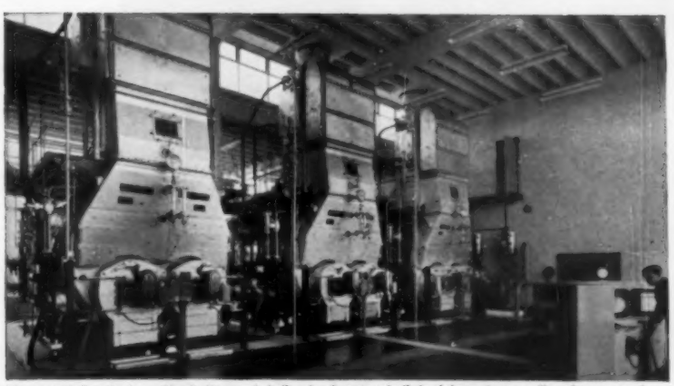
Bottom-Hole Heater

Texsteam Corp., Houston, has developed a bottom-hole thermal unit for stimulation of wells producing high-viscosity crude and for paraffin removal. The unit weighs only 157 lb, and is claimed to have a thermal efficiency of 80%. In practice, fluid is heated in the Texsteam unit and pumped through macaroni pipe to bottom-hole heat exchangers attached to these production tubing string and these back to the surface through a second macaroni string. Fuel consumption is 450 cu ft per hour at 1 psi.

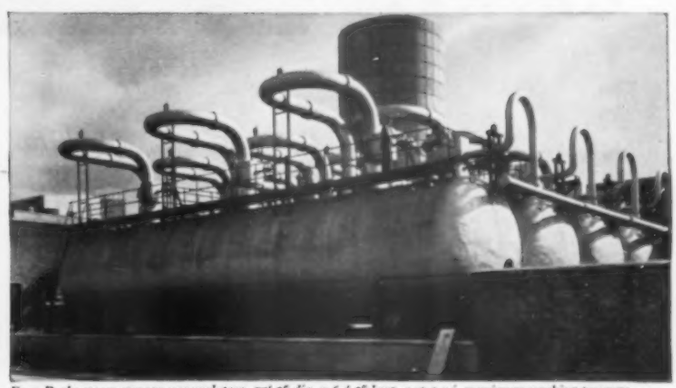
Gardner-Denver Report

Sales of Gardner-Denver Co. were $14,048,352 for the first quarter of 1958, down 16.7% same 1957 period. But incoming orders are picking up slightly, and 1958 volume should approach that of 1956, second best year in the firm's history—according to G. V. Leece, president. In spite of the current downward dip of the economy, Gardner-Denver is proceeding with a major expansion program, Mr. Leece said. Capital expenditures for the first quarter of 1958 totaled $850,000, compared with $578,000 for the first quarter of 1957. Total capital expenditures for 1958 are estimated at $2,750,000, compared with $3,482,000 for 1957.

STEAM at a rate of ONE MILLION POUNDS PER HOUR



Three 9' 6" dia. Cochran Sinuflo Economic boilers having a total oil-fired duty of 38,000 lbs. of steam per hour at 250 p.s.i.



Four Ruths steam storage accumulators, 13' 0" dia. x 64' 0" long, 250 p.s.i. maximum working pressure.

Steam at the rate of one million pounds per hour is supplied for test purposes at the works of Bristol Aero-Engines Limited by Sinuflo Economic boilers and Ruths steam accumulators made by Cochran & Co., Annan, Ltd. At this high rate of steam flow, no pressure drop is reflected back to the boilers and no change is necessary in the boiler firing rate. Similar plants, usually much smaller, are applicable to any steam-using industry where severe fluctuations in steam demand present a problem.

SINUFLO ECONOMIC

COCHRAN BOILERS

RUTHS ACCUMULATORS

Cochran & Co., Annan, Ltd., Annan, Dumfriesshire, Scotland and at 34, Victoria Street, London, S.W.1

TAS/CH.614

for the manufacture of cracker tubes for oil refineries. An interesting example of the company's research work is displayed in a flow diagram of fuel and air in an open-hearth furnace, the first furnace to be constructed on the basis of many years of aerodynamic study conducted by the company's research and development department. This work is already having its effect in the construction of boilers and oil stills. To complete this display of service to the chemical and petroleum industries, examples will be shown of permanent way materials suitable for private rail tracks and sidings, both at home and abroad.

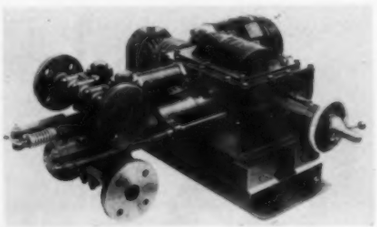
Dewrance & Co. Ltd. will be exhibiting a selection of valves and other equipment appropriate to the process industries and for general industrial service. The Dewrance consolidated safety relief valves, 1900 type, are suitable for petroleum liquids, gases, and vapors, and are used extensively in refineries throughout the world. Duragauges are a standard fitting in the petrochemical industry, being constructed of materials selected for service under conditions of complex petrochemical processes. Units of the American Microsen system of electronic control now being manufactured under an exclusive license will also be shown. Other exhibits will include a pneumatic transmission system for pressure indication up to 20,000 psi, liquid-level indicators, expansion joints, and a compact lapping machine for lapping in one operation both seat faces of parallel slide valves *in situ*.

The many developments which the company has recently made in the field of chemical and petroleum engineering—particularly in heat-exchange equipment—will be demonstrated by Newton, Chambers & Co. Ltd. An agreement with the Struthers Wells Corp. of America has enabled that firm's industrial heating equipment to be made and sold in the United Kingdom. By arrangement with Industrikemiska Aktiebolaget, of Stockholm, the "Inka" radiation-type preheater will also be manufactured and sold. Recently, Newton-Chambers have acquired world rights for the Coal Tar Research Assn.'s process for the hydrofining of crude benzols, naphthas, etc. A pilot plant has already been installed for testing customers' feed stocks. Models will be shown of a continuous tar-distillation plant of up to 250 tons per day capacity, and of a gas-purification plant of 12 million cubic feet per day capacity. The company has modern facilities for the fabrication of heavy pressure vessels and all types of welding fabrications, and is approved for such work to Lloyds Class I and admiralty grade "A" requirements.

Spraying the Deloro "Stellite" powder onto the cold work piece.

Deloro Stellite Ltd. will be demonstrating the hardfacing of sleeves both by the spray-fuse process and the normal oxyacetylene method. The spray fusing of "Stellite" powder was introduced by the company only in September of last year, and is an advance on normal cold-spraying because the alloy deposited, with its valuable properties, is actually welded on the base metal. This versatile alloy enables practically all conditions and combinations of corrosion, wear, and heat to be successfully withstood. A feature of the display will be a wide range of valves protected with "Stellite." An accompanying illustration shows "Stellite" powder being sprayed onto the cold work piece and the fusing of the deposit with an oxyacetylene torch.

The exhibit of E.C.D. Ltd. will cover a range of pumps—together with ozone-generating equipment for office, industrial, hospital, and laboratory use. The piston diaphragm pump has been designed to meet individual specifications, and is able to with-



E.C.D. Ltd. high-duty duplex pump.

stand pressures up to 2,000 psi. Single units have capacities up to 500 gal per hour, double and treble units up to 2,000 gal per hour. The pumps are fluid-operated, and their output is continuously variable from zero to a maximum. Other models include a solenoid-operated plunger pump for automatic titration and similar laboratory duties; a high-duty duplex pump, especially designed to pump highly volatile or exceedingly viscous liquids up to 200 poises. The hospital ozone-generating equipment is designed for deodorization of wards, consulting rooms, etc.; while the model for laboratory use is complete with instrumentation and controls for giving a complete range of ozone production. Also shown will be a self-contained airconditioner, and a dissolved-oxygen recorder employing the amperometer method to give a direct linear response to changes in oxygen content.

Audley Engineering Co. Ltd. will be exhibiting a wide range of valves which will include the Audco lubricated taper plug valves manufactured in a variety of materials, viz., cast-iron, carbon, alloy, and stainless-steel; bronze, monel-metal, and aluminum—comprising straightway, multiport, and

GASKETS

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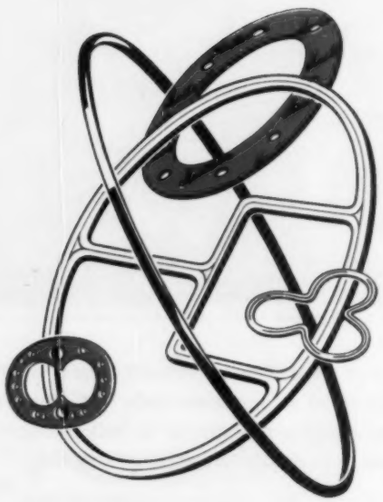

A.P.I. RINGS; METAL COVERED ASBESTOS; MACHINED SEALS;
WOVEN ASBESTOS; CORRUGATED RINGS; C.A.F. JOINTS;
SPIRAL WOUND GASKETS; WASHERS; PACKINGS; SHIMS, ETC.

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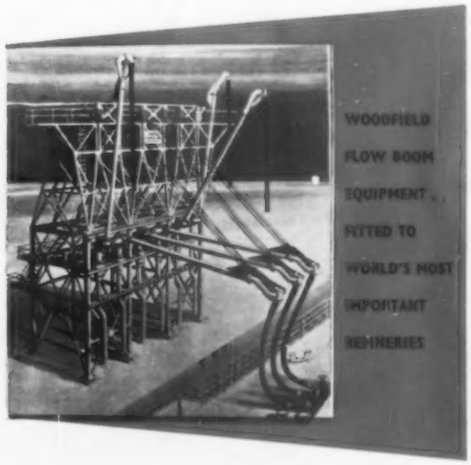
CHEMICAL AND PETROLEUM

ENGINEERING EXHIBITION

CHEMICAL & PETROLEUM ENGINEERING EXHIBITION
OLYMPIA 18-28 JUNE 1958

Ideco-Woodfield H-20 drilling and servicing hoist and Kwik-Lift Mast, as illustrated, is typical of the range of IDECO equipment built under licence in the United Kingdom. Flow Boom Equipment for loading and unloading of tankers, and the LeBus Counterbalanced Wire Line Spooling System are on show in London for the first time, together with a representative display of Woodfield's activities.



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FRINDSBURY WORKS, ROCHESTER, KENT

Phone: STROOD 78421 Grams: Woodfield Telex, Rochester

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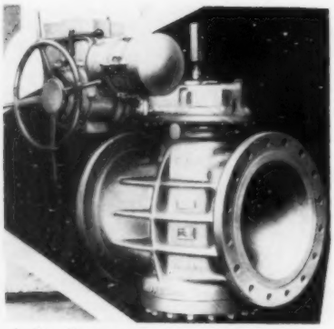
IDECO WOODFIELD

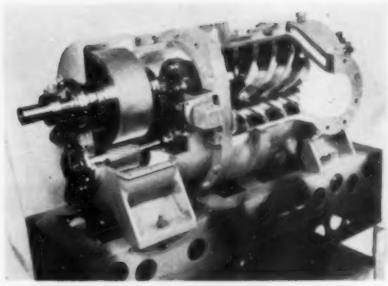


Audley Engineering 16-in. class 150 carbon-steel hypreseal-type valve, fitted with Rotork electric actuator.

steam-jacketed designs. Sizes range from ¼-in. to 24-in., with pressures from the finest vacuum to 5,000 psi. A christmas-tree well-head assembly is to be displayed—together with examples of remote controlled, pneumatic, and electrically operated Audco valves.

Stothert & Pitt Ltd. are exhibiting fuel-oil and lube distribution pumps, as well as a range of centrifugal pumps. Main exhibit of their associated company, Torrance & Sons Ltd., will be the recently developed T.A.P. fully automatic 24-hour process unit for continuous dispersion and/or fine grinding of solid particles in the liquid phase. Also, the company's well-known and mixing, grinding, and dispersing units will be shown.

An efficient rotary positive-displacement oil-free gas compressor-exhauster is being shown by James Howden & Co. Ltd. for the chemical and oil industries. Gas is delivered with nonpulsating flow, and there are no valves on the compressor.



Howden rotary positive-displacement gas compressor.

Standard range at present covers requirements from 800 cfm to 8,500 cfm—with outlet pressures up to 60 psig on a single stage, and up to 150 psig in two stages, when inlet conditions are atmospheric. As an exhauster with atmospheric inlet, the machine is suitable for subatmospheric inlet pressures down to 3 psi absolute.

Siebe, Gorman & Co. Ltd. will exhibit a line of breathing apparatus—including a compressor set for six men for tank cleaning, etc.; two versions of self-contained compressed-air apparatus; protective clothing, respirators, and other safety equipment for oil workers, as well as the new full-vision Vista mask.

General Descaling Co. Ltd. provides a complete service for cleaning sewers, drains, culverts, and industrial pipelines. Oil pipeline equipment includes scraper traps and closures; gaging, cleaning, swabbing, and batching pigs; go-devils; magnetic and isotope pig detectors.

Kent "Commander KE" high-speed electronic self-balancing temperature recorder.

George Kent Ltd. devote the greater part of their stand to the Commander range of instrumentation—with one section demonstrating interchangeability of standardized units and assemblies. Possible alternative combinations available in the Commander range today tota' many hundreds of thousands—enabling the user to receive a custom-built instrument from standardized components.

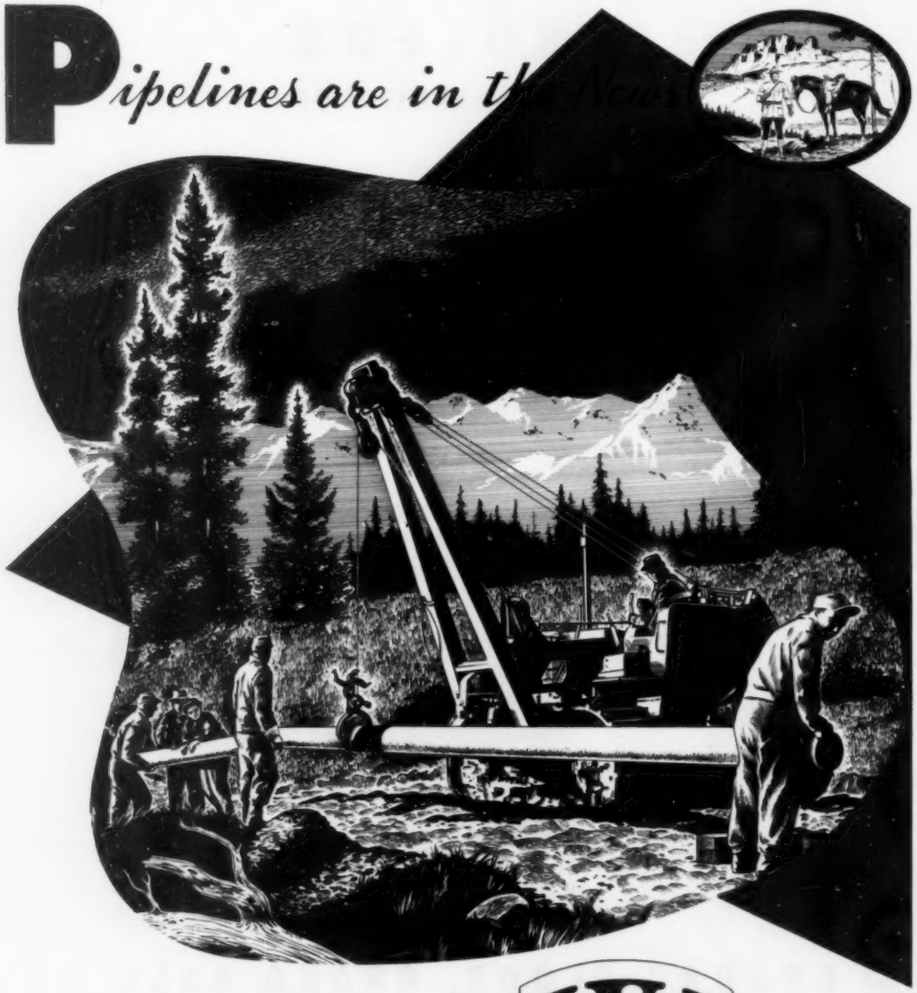
A new plastic styrene-butadiene tubing, called Durapipe, will be displayed by Barflo Ltd. For tough, noncorrosive, high-temperature and -pressure service, it can be solvent-welded to give a homogeneous joint.

An entirely new design for high-pressure bonnetless gate valve, for pressures up to 1,500 psi and temperatures up to 770 F, will be shown for the first time by British Steam Specialties Ltd.

Among the range of sheet filters which John C. Carlson Ltd. will show is the new Zenith Princess filter constructed in stainless steel.

John Dalglish and Sons Ltd. will exhibit conveyor and spray dryers for use in a variety of materials from simple basic chemicals to complex organic compounds and food products. This equipment is newly available in Britain and the sterling area generally.

Shown for the first time in this country, by Dorr Oliver Co. Ltd., is a rotary vacuum filter in P-V-C construction—for solution of filtration problems


Pipelines are in t
Watch . . .
WILLIAMS BROTHERS
New York
Washington — Pittsburgh — Louisville
Minneapolis — New Orleans — Caracas
Bogota — La Paz — Edmonton
Calgary — London — Ankara — Tehran
ENGINEERS-CONSTRUCTORS
NBT BUILDING TULSA, OKLAHOMA
CABLE ADDRESS: WILLBROS

where corrosive conditions require that contact between process material and metallic materials of construction be avoided. Also on display will be the Dorr-Oliver Fluo-Solids system—a new technique for roasting, calcining, and drying.

Elga Products Ltd. will display newly developed units for ion exchange and de-ionizing—the "Elgastat field research unit" which provides high-quality distilled water without use of power. Lake, well, or river water may be used as the influent.

Among new products, Gilbarco Ltd. will exhibit for the first time in this country a completely automatic system for loading-rack control—incorporating latest advances such as automatic typewriting and punch-card operation.

The Imperial Chemical Industries Ltd. (Metals Division) exhibit will feature their development of titanium-lined vessels and components. The exceptional resistance of titanium to a wide variety of aggressive liquids and gases will be demonstrated.

Among a wide range of valves, Langley Alloys Ltd. will show the DIN standard "Y" valve produced in stainless steels.

Outstanding exhibit of Manesty Machines Ltd. will be the Manesty DryCota combined tabletting and compression coating machine—with new features shown for the first time in Great Britain. This machine is also capable of coating shaped tablets, i.e., capsule shapes and shapes other than round. Two new tablet machines; a new double rotary tablet unit incorporating 39 pairs of punches; and the new heavy single-stroke machine, the "35T," for tablets up to 2¼-in. diameter also will be shown.

Merrill Pumps Ltd. will exhibit several entirely new valves—including their novel diaphragm and pressure-relief valves.

Metaducts Ltd. are showing for the first time a range of "Metamix" mixers.

The Meynell "Rayon-Patent" stop valve—entirely new to Great Britain—will be shown for the first time. Perfected for handling corrosive fluids, the company has just obtained sole manufacturing rights for England and the commonwealth.

Among recently developed products, L. A. Mitchell Ltd. will exhibit its newly designed pump—based on corundum-type ceramic material for both body and impeller. A vertical-type pump, it is self-priming—with a mechanical seal against gland shortcomings.

Among Premier Colloid Mills Ltd. exhibits will be the new 3-in. and 6-in. dispersion mills for industrial use wherever dispersion and fine grinding are required.

Among featured items of Power Gas Corp. Ltd. will be its recently introduced "Braun" heat exchanger—21 ft long, 4-ft-diameter. On show for the first time will be working models of an industrial crystallization plant and a Wiggins dry-seal gas holder.

Silverton Machines (Sales) Ltd. are exhibiting an entirely new immersion-type ball mill—with reduction in manufacturing time claimed to be 20%. Principle of the machine is that materials are sucked into a working rack, and all powders and pigments are ground to a fine impalpable texture by a number of stainless-steel balls.

Taylor Controls Ltd. will be showing at least three new controls: the Transcope recorder with Servomatic power pens 150 times more powerful than the conventional type; the Potentiometer transmitter—unique concept in a bridge balancing potentiometer; the transcope controller, a nonindicating miniature pneumatic instrument utilizing metallic bellows as pressure receivers.

U.S. Rubber International (G.B. Ltd.) are to exhibit the latest addition to the Amazon range of hose, the Amazon 2323, a flexible submarine hose, together with a model of the Amazon hose rig.

Charles Wicksteed & Co. (1920) Ltd. will be showing for the first time a tube-expander torque-control inset—suitable for the portable electric drill-type motor, and developed for the controlled expansion of heater- and condenser-type tubes—as well as a new type of internal tube cutter suitable for small bore tubes in the ⅝-in. to 1-in. range.

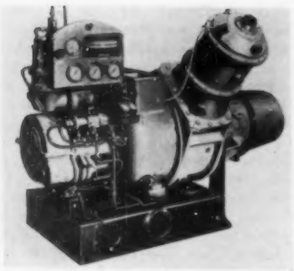
First time on exhibit in the UK, by Woodfield Hoist & Associated Industries, will be the LeBus counterbalance wire-line spooling system—with advantages claimed over conventional systems. Also on display will be the Woodfield W.V. 50 chassis—on which is mounted the Ideco-Woodfield H 20—specifically designed for use on drilling rigs in production service.

Increasing sizes of tankers and use of larger pipelines and ship-to-shore connections have introduced problems in handling and in prevention of damage. 10- and 16-in.-diameter hoses are too heavy for luffing and drift. Specially designed Woodfield tanker-loading equipment for this situation has proved economical and successful. With push-button control, the installation is designed for one-man operation.

Worthington-Simpson Ltd. will show a selection of chemical, petroleum, and power pumps—together with rotary and "Monobloc" air compressors. Maximum pump capacities exhibited will be 675 gal per min—with heads up to 130 ft. Compressor exhibits include one of "Monobloc" construction and a recently introduced oil-cooled rotary.

The Power-Gas Group is represented by Power-Gas Corp. Ltd., Ashmore; Benson, Pease & Co.; Rose, Downs & Thompson Ltd. They will display an oil-refinery heat exchanger 21 ft in length; sample welds from a variety of metals; machined castings; pressure-tested stainless-steel pipe work. A model employing crystallization by the Krystal process will be shown—with samples of 35 different chemicals crystallized in Krystal apparatus. A working model of a Wiggins dry-seal gas holder for the chemical industries will be displayed, as well as a model of the largest cyclic catalytic oil-gas plant in the world. Flow diagrams, drawings, and photos of plant and equipment engineered, manufactured, and erected illustrate the companies' ability to carry out complete projects.

Ruston & Hornsby will display their "TA" 750 to 1,000-kw gas turbine. Repeat orders for this ideal oil-field prime mover for electric generation and pumping duties have been placed by well-known companies in Europe, the Middle East, and South America. Also on display will be the new small Mark "TE" 430-bhp gas turbine—particularly useful for small portable alternator sets and for pump and compressor drives; and, in the small-engine class, a range of air-cooled diesel units. Largest diesel on



The Ruston "TE" 430-bhp industrial gas turbine.

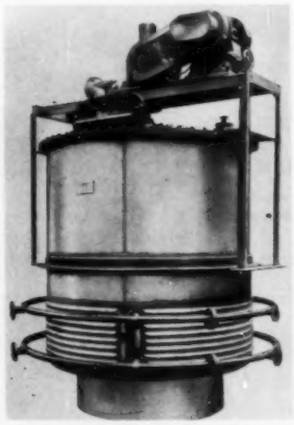
exhibit will be a 6-cylinder 540-bhp medium-speed pressure-charged engine—one of 20 oh order by National Iranian Oil Co.

The "TA" and "TE" run on natural gas. Air-cooled, they are independent of water supply.

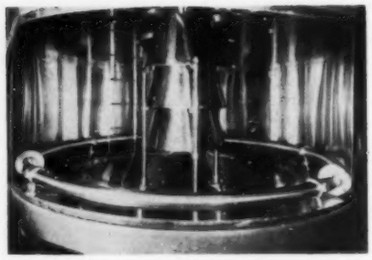
Type 2RCS4 roller kelly-drive bushing manufactured by Baash-Ross Tool Co. Division of Joy-Sullivan Ltd. at Greenock, Scotland.

From the wide range of Baash-Ross Tool Co. oil-field drilling equipment, used throughtout the world, will be exhibited some now available in Great Britain and produced by Baash-Ross Division of Joy-Sullivan Ltd. at the Cappielow factory, Greenock, Scotland.

Exhbiits of A.P.V. Co. Ltd., representing chemical engineering service in the distillation and fermentation fields, include a range of stainless-steel plant and fabrication facilities. In the center of a display of models, plates, and photographs illustrating continuous and batch distillation of coal-tar products and industrial and potable alcohol will be an 80-ft-high benzol distillation column, 4 ft 6 in. in diameter. The Paraflow plate heat exchanger and the Rosenblad stainless-steel spiral model will be shown. Two bulk heat-transfer systems include the A.P.V.-"Heil" in-wall cooling and heating system, and the



The A.P.V. "Heil" system of wall heating and cooling is seen in this steam-heated kettle.



The A.P.V. "Watts" heater.

"Watts" heater for high heat-transfer efficiency with low steam consumption.

The comprehensive display of Samuel Osborne & Co. Ltd. (Sheffield steel makers) will include every type of tool; castings in carbon and alloy steels and chrome-nickel heat-resisting alloys; rolled- and extruded-steel sections; castings by precision methods.

Belmos Co. Ltd. will exhibit flameproof and industrial-type switchgear and motor-control gear supplied to the chemical and petroleum industries. In the UK, Belmos equipment is used extensively in oil pipeline heating systems and in synthetic rubber plants. The company supplied the main control gear for pumps and compressors at the pumping stations on the 300-mile Trans-Iranian pipeline. Flameproof units have been exported to refineries and pumping stations in the Far and Middle East, and South America.

Mission Manufacturing Co. Ltd. (wholly owned by the Houston, Texas, firm) will exhibit the complete range of its well-known slush-pump parts manufactured at its Belfast factory—including the E.Z. swabs and the new Mud Monarch slush-pump valves and Super Service liner packings.

Its complete line of services to the oil and chemical industries will be demonstrated by Johnson, Matthey & Co. Ltd.—with emphasis on platinum and alloy applications. Among these are the platinum catalyst employed in "reforming" by refineries

PERFEX 62

ALL THE OIL NEWS *FAST* — *including concession terms and oil laws*

IN

WORLD PETROLEUM REPORT

An outstanding and authoritative source — with features not found in any other publication — on all the oil news. It consists of:

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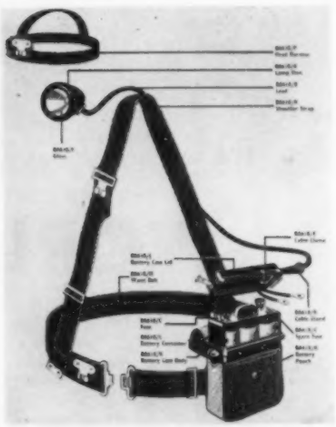
throughout the world; platinum and rhodium-platinum alloys in glass-handling equipment; platinum anode construction for cathodic protection of ships, etc. A comprehensive range of high-purity chemical compounds for process and research also will be on display.

Denso tapes for underground and under-water protection of metals against corrosive influences are featured by Winn & Coales Ltd., specialists in anti-corrosion products. Applications include gas and water mains, structural steelwork, and oil pipelines. Denso tapes are equally effective when applied under damp or greasy conditions where it is impossible thoroughly to clean and dry the metal before wrapping. Even partly corroded metals are given full protection, existing corrosion is neutralized, and further corrosion prevented.

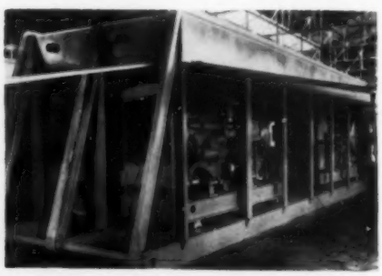
Electrodes and accessories for metal arc welding in the chemical and petroleum industries will be shown by Murex Welding Processes Ltd. An important exhibit will be the new "Fastex 100" hand welding electrode especially developed for hand welding of pipe joints *in situ*. Also displayed will be the latest range of electrodes for welding stainless steels to meet the stringent requirement of the atomic energy authorities. Specially designed for oil-field pipeline work is the "Overlander" 300- to 400-ampere mobile diesel-engine-driven arc-welding set. All Murex rotary equipment now incorporates the "Dynex" generator—making stepless current adjustment possible.

Powell Duffryn Carbon Products Ltd. will display examples of the well-known Delanium graphite heat-exchange equipment. Largest heat exchanger on the stand—in the form of a graphite block 6 ft long—provides 200 sq ft of heat-exchanger surface, and is offered with either 9-mm or 30-mm process liquor holes according to duty. Smallest unit has only 4 sq ft of heat-transfer area. A full-size 50-sq-ft working model—assembled in "Perspex" material to make operation clearly visible—demonstrates the principle of cubic heat-exchanger design. Another model demonstrates Delanium graphite bursting discs (now in production) with bursting pressures from 1 to 75 psig; sizes, 2-, 3-, 4-, and 6-in. bores.



Components of General Electric's lighting set —with battery to be worn on breast so as to leave wearer's both arms free.

Among General Electric Co. Ltd.'s exhibits for oil-field and refinery services will be a pressurized system for electrical apparatus against hydrogen hazards—for pressurization at ¼ psi and more; control gear—including an automatic flameproof gate-end panel for control of 400- to 650-volt squirrel-cage motors, and a squirrel-cage splashproof machine for driving beam-type oil-field pumps; also the GEC Litealarm audible and visual warning system against explosion hazards; a portable working and inspection light, with a breast battery, for use in flammable-vapor areas.



Auto Diesels-Leyland Motors utility power house, incorporating three 90-kva alternator sets, for operation in Libya: Superstructure carries 1,500-gal (imperial) tank automatically refueled by fuel transport pump from bulk supply.

Auto Diesels Ltd., in conjunction with Leyland Motors, will show a range of equipment for oil-field drilling and exploration. A complete portable utility power house—comprising diesel-driven generators for use on rigs and associated equipment—features engines which have parts interchangeable with those fitted into Leyland trucks.

Vokes Genspring constant-support hanger.

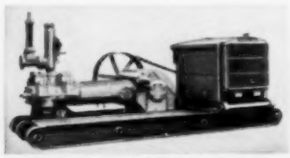
The Vokes Group (comprising Vokes Ltd. and Vokes Genspring Ltd.) is showing a variety of their products—including latest developments in filtration equipment, and a comprehensive range of pipe suspension gear. The pipeline filters for removal of oil mist, dirt, water, and other impurities from compressed-air lines, with an efficiency of 99.9%, will be on view. The wide range of air filters include latest "absolute" types used extensively in the

SPECIFY

ROLLS-ROYCE **Diesels**

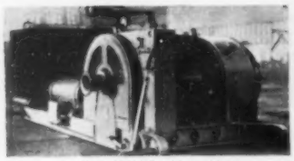
The suitability of Rolls-Royce diesels for a wide variety of installations is proved by the fact that a dozen of the world's leading Oil Companies in South America, Trinidad, Iraq, Kuwait, and Borneo are placing orders for Rolls-Royce powered equipment. National Oweco and Woodfield Hoist Ideco are using Rolls-Royce diesels in work-over hoists, service drilling rigs and slush pumps. On Lake Maracaibo Shell are operating over seventy Rolls-Royce diesels in high speed launches and workboats, in addition to a large number in Coles Cranes, Consolidated Pneumatic Compressors, Scammell Trucks and Petbow Generators.

Pulsometer Pump



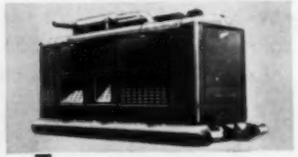
Dawson and Downie Pump

National Oweco Drilling Rig



Woodfield Swabbing Unit

Consolidated Pneumatic 365 - R.O.2



Petbow 182 k.w. Generator

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in lower operating costs in earth-moving, trucking, oil field, railway, marine and industrial operations from the Arctic to the Antipodes.

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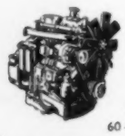
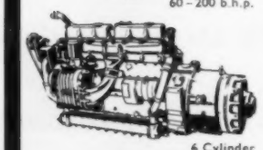
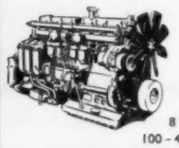


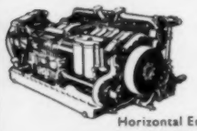
4 Cylinder
60 - 200 b.h.p.



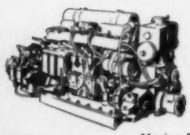
6 Cylinder
with Torque Converter
80 - 300 b.h.p.



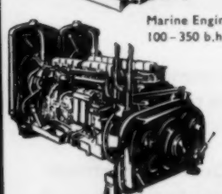
8 Cylinder
100 - 400 b.h.p.



Horizontal Engines
100 - 400 b.h.p.



Marine Engines
100 - 350 b.h.p.



Twin 6 & Twin 8
Power Packs up to 600 b.h.p.

THE *NEW* HIGH PRECISION AUTOMATIC CONSTANT WEIGHT FEEDER

Sinex C. W. Feeder and control panel for output range of 25 lbs/hr to 250 lbs/hr designed for use in Chemical Works.

For use in Batteries or singly.
For accurate Continuous Proportioning.
Guaranteed Accuracies to within ½% available.
Robust and Reliable. Completely Automatic.
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Each type of machine is designed to suit your particular material and application.

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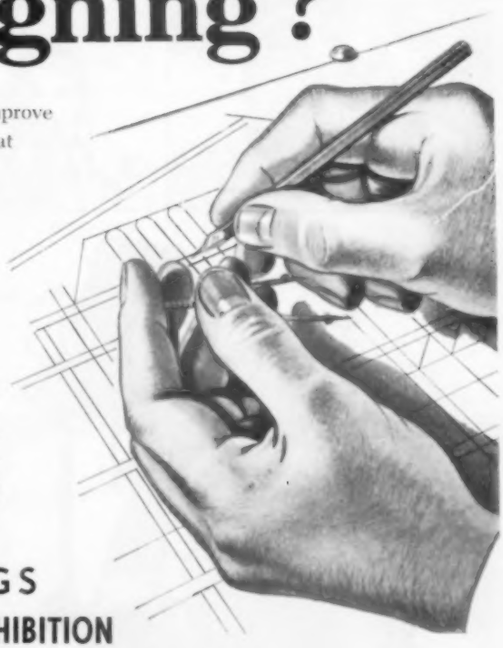

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in phosphor-bronze, gun-metal, aluminum-bronze, manganese-bronze, and light alloys. Precision machined bushes and bearings. Specialists in high-tensile aluminum-bronze castings, centrifugal-cast wheel blanks, and chill-cast rods and tubes.

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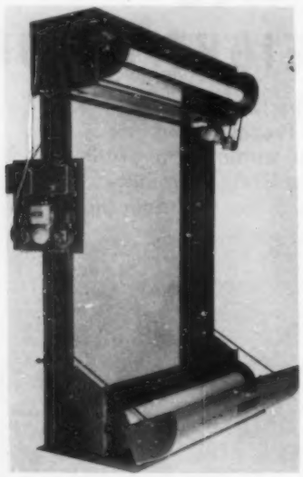
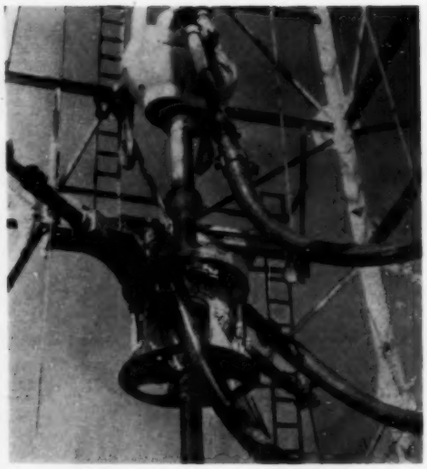
atomic energy, biological, and photographic industries.



Vokes Ltd. "Autoroll" automatic or manually operated air filter.

The box-type canister filter, on test, has attained filtration efficiencies of 99.97%, while another exhibit constitutes an ideal prefilter to the "absolute" panels. The "Autoroll," an automatic screen-type filter, also will be seen—together with rotary screen type developed for bulk air filtration. A versatile range of support hangers—with innumerable uses wherever piping is used—will be on display. The heavy-duty constant-support hangers also will be featured—with illustrations showing their use at Calder Hall and Chapel Cross. END



Baash-Ross Power Swivel

A new device to speed drilling of oil-well and construction work bore holes has been developed by the Baash-Ross division of Joy Manufacturing Co. The device, a rotary power swivel, eliminates the conventional drilling swivel, the kelly, the kelly-drive bushing, the rotary table as a rotary device, and the compound chain drive used to rotate the rotary table. It can be attached to the upper end of drill pipe, and can be driven hydraulically, electrically, or by air.

The power swivel permits the use of multi-joint stands of drill pipe to reduce the number of connections which must be made on the rig floor. Stands of 60 ft to 90 ft can be connected into the drill string at one time—stand length being limited only by the height of the derrick. It permits the cutting of longer cores, as it is not necessary to pick up from the bore face every 30 ft to make a new connection as with conventional equipment. It also permits drilling or reaming up holes, as well as drilling down.

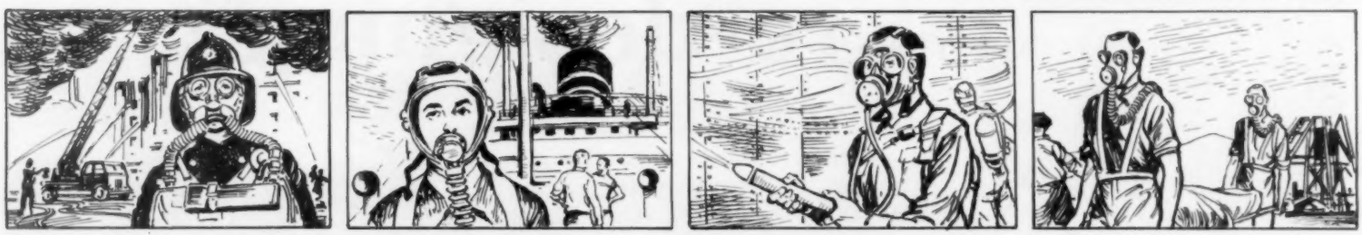
Present at the April meeting of the Houston Chapter of NOMADS were (left to right) Barney Doak, of Calgary, and Calvin Jensen, of Edmonton, Canada—both of W-K-M. Also Adolph Iglecia, of Buenos Aires, representing McEvoy Co., in Argentina; and M. Margolin, of Tel Aviv, Israel—with Israeli Water Works.

New Seismic Method

Continental Oil Co. reported progress in its Vibroseis seismic method at a recent meeting of the Tulsa Geological Socy. The method, which still is in the experimental stage, involves the use of rotating weights actuated by an electric motor to impart energy to the earth. The mechanical earth vibrator exerts a force of 14,000 psi at a frequency of 60 cycles per second. Reflections are recorded on a magnetic tape for office analysis. Shot-hole drilling and the use of explosives is eliminated. Description of the method was given by John M. Crawford, director of exploration research, and William E. N. Doty, supervising research geophysicist, co-inventors of the vibrator.

Whatever the hazard . . .

The Chemical & Petroleum Engineering Exhibition
Stand Number Five, Row K, Ground Floor



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THE MARK II COMPRESSED AIR BREATHING APPARATUS

Approved by the British Ministry for use in ships

This compact and self-contained air breathing apparatus has a 1100 litre cylinder charged to 125 atmospheres. Outstanding features of safety include the permanent attachment of the set and safety line to the harness, which is made of 'Terylene' polyester fibre. The safety line is spliced to a 'D' ring on the harness. The equipment is approved by the British Ministry of Transport for use in ships.

SIEBE, GORMAN are long-established suppliers of all types of safety equipment to the Admiralty, the Public Services and Industry.

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TGA T6

(Continued from page 52)

	Net Income	Per Share of Common	Net Working Capital	Net Capital Assets	Funded and or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Canadian Petrofina Ltd.								
1957	**1,707,120**	....	**8,648,668**	**103,970,888**	**26,536,000**	**5,966,374**	**20,000,000**	**20,384,902**
1956	1,897,123	....	5,572,260	103,632,120	30,928,500	5,282,922	20,000,000	20,796,870
1955	1,026,289	....	13,618,433	98,652,790	40,493,000	4,856,824	20,000,000	15,220,425
Imperial Oil Ltd.								
1957	**72,080,930**	**2.29**	**231,885,515**	**488,990,895**	**90,775,509**	.....	**31,442,652**	**302,339,804**
1956	69,098,692	2.20	254,490,598	429,525,403	94,170,388	.....	31,429,887	267,986,536
1955	62,145,140	2.08	207,612,418	372,519,508	96,628,338	.....	29,865,691	235,307,515
McColl-Frontenac Oil Co., Ltd.								
1957	**13,929,678**	**4.25**	**38,483,822**	**71,723,675**	**29,068,500**	**40,000**	**3,238,453**	**62,792,505**
1956	12,765,028	3.95	35,519,709	67,132,550	31,019,278	40,000	3,174,769	43,611,556
1955	10,283,094	3.85	26,952,791	47,292,239	21,665,000	60,000	2,607,963	35,760,861
Royalite Oil Co. Ltd.								
1957	**669,828**	.....	**2,677,920**	**36,270,437**	**28,255,000**	**164,053**	**2,952,342**	**4,143,477**
*1956	761,178	.....	5,670,478	35,298,540	29,760,000	167,473	2,945,502	5,682,819
*1955	118,045	.....	9,057,623	34,536,381	31,558,318	200,000	2,880,448	5,629,144

*After retroactive adjustments.

LATIN AMERICAN OIL COMPANIES

Creole Petroleum Corp.								
1957	**396,906,700**	**5.11**	**43,787,000**	**879,542,700**	.....	.....	**77,618,760**	**501,758,997**
1956	336,433,600	4.34	131,463,100	696,523,800	.....	.....	77,595,930	414,066,859
1955	292,943,900	3.78	197,158,200	585,656,000	.....	.....	77,595,930	368,617,941
International Pet. Co. Ltd.								
1957	**41,135,288**	**2.83**	**80,149,470**	**222,298,932**	.....	.....	**14,529,955**	**171,855,556**
1956	38,247,126	2.63	87,199,476	179,045,626	.....	.....	14,525,608	151,060,143
1955	35,064,672	2.41	121,630,542	120,008,446	.....	.....	14,524,088	132,421,922
***Sinclair Venezuelan Oil Co.**								
1957	**10,036,582**	**2.51**	**27,260,667**	**62,013,643**	**13,000,000**	.....	**4,000,000**	**70,370,932**
1956	9,152,237	2.28	29,581,086	51,691,879	15,000,000	.....	4,000,000	60,314,350
1955	5,038,613	1.25	23,468,686	48,330,314	15,000,000	.....	4,000,000	51,162,113

*Formerly Venezuelan Petroleum Co.

EUROPEAN OIL COMPANIES

British Petroleum Co. Ltd.								
1957	**£ 52,018,461**	**£0-10-3**	**£ 52,574,510**	**£ 158,883,026**	**£ [2]26,767,600**	**12,706,252**	**101,050,430**	**£ 151,549,632**
1956	53,014,561	0-10-6	43,990,585	134,756,703	18,697,400	12,706,252	101,025,568	158,343,248
1955	45,308,243	0- 9-0	61,859,526	124,935,305	19,072,900	12,706,252	100,688,000	116,698,094
Royal Dutch-Shell								
1957	**£212,721,031**	"	**£601,046,863**	**£1,040,117,401**	**£ 179,079,352**	"	"	**£1,417,155,000**
1956	179,528,055	"	515,700,658	952,685,018	169,429,637	"	"	1,248,734,000
1955	159,992,265	"	525,946,670	820,767,880	170,556,112	"	"	1,108,289,000

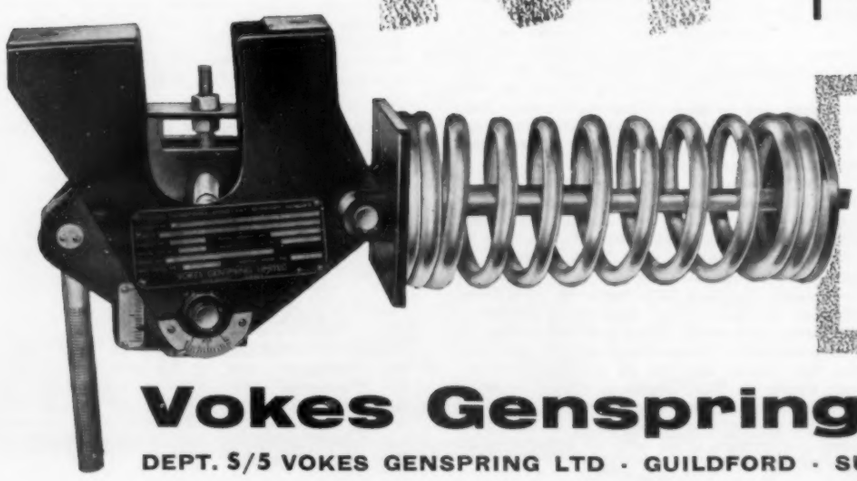
[1]Excludes plant and property of certain subsidiary companies.
[2]Ownership is 60% Royal Dutch Petroleum Co. and 40% The "Shell" Transport and Trading Co., Ltd.

END

Announcing a NEW range of Constant Support Hangers

Vokes Genspring M range

The Vokes Genspring 'M' range of Constant Support Hangers is the culmination of long, practical experience and laboratory research by Vokes' engineers. Originally designed for rugged marine use, the 'M' range is more economical, both in application and first cost, and more compact than existing types; it also requires less headroom. Together with the other Vokes Genspring Constant Support Hangers, the new 'M' range provides the solution to any pipe suspension problem. *If you would like to know more, please send for full details of both types of Vokes Genspring suspension systems.*



Features of the new 'M' range:

- Lower first cost
- Increased travel
- Less headroom required
- Suitable for all applications

Vokes Genspring SUSPENSION SYSTEMS

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VG/22

INTERNATIONAL NEWS AND NOTES

Sir Neville Gass, chairman of The British Petroleum Co., has been touring BP interests in the Middle East. He is shown during his visit to the Persian Gulf, where he was received by the Ruler of Abu Dhabi, Sheikh Shakhbut bin Sultan, and traveled by helicopter to the offshore drilling platform "Adma Enterprise," which is operating some 20 miles off Das Island.

Pan American Enters Libya

Concessions in Libya totaling nearly 23 million acres have been awarded to Pan American Petroleum Corp. by the Libyan Petroleum Commission. They are beign assigned to a newly-formed company, pan American Libya Oil Co. The awards were announced by C. F. Dohm, president of Pan American International Oil Co., who said Pan American Libya, a subsidiary of Pan American International, has been formed to carry out operations in the new concession areas. Three tracts—one in Zone III and two in Zone IV—comprise the new concessions.

Tract 76, a square area of 9,202,498 acres, is in Zone III—its western boundary coinciding with the western boundary of the zone. It is about 285 miles south of the Mediterranean seacoast at the point where the Gulf of Sidra indents the North African shoreline. Tract 75, largest of the three, lies in the Fezzan basin, approximately 500 miles south of Tripoli and 190 miles southeast of the Atshan discovery in Tract 1, which lies along Libya's western border. Tract 75 contains 11,049,324 acres, and is in Zone IV.

Tract 74, consisting of 2,705,745 acres, lies about 330 miles southeast of Tripoli and 160 miles to the northeast of Atshan. It is on the northeast edge of the Fezzan basin, and lies along the northern edge of Zone IV.

Mr. Dohm said that, while detailed exploration plans have not yet been worked out, plans are under way for sending geological and geophysical personnel to Libya at an early date. All three of the concessions are for terms of 50 years. In other respects, they conform with the provisions of the Libyan oil law of 1955. Pan American International is the eastern hemisphere subsidiary of Pan American Petroleum Corp., Tulsa, which in turn is the production affiliate of Standard Oil Co. (Indiana).

Sicilian Crude Potential 33,000 B/D

Scota. Mediterranea Raffineria Siciliana Petroli has been authorized to build a complete 52,000 b/d refinery with pipeline facilities—to be expanded eventually to 100,000 b/d. To be located near Milazzo, 100,000-ton tankers can be loaded. Crude will be Middle East.

A total of 56 wells were drilled in 1957—with total depth of 84,056 meters. Crude production was about 23,100 b/d—of which over 22,000 b/d was by Gulf. 22 drilling rigs and 13 geological and seismic teams were active. $8 million was collected in production taxes, rents, and royalties—plus several millions in refining and marketing taxes.

Officials report 50-50 profits split will continue.

Gulf's capacity from 32 producing wells in Ragusa is 35,000 b/d—but production has been less than capacity. Gulf expects production of 30,000 b/d in 1958—of which 6,000 b/d to 7,000 b/d would be exported.

ENI's four producing wells have a potential of 3,000 b/d; five rigs are active.

Also exploring in Sicily are Edison group, of Milan; British Petroleum; Montecatini (with Gulf); Lion Oil; and Esso Standard.

Australian Drilling Program

Australian officials plan a subsidy drilling program for 1958-59 fiscal year in April; and, for calendar year 1959, in October. Action was disclosed after the Minister for National Development approved a drilling program for six companies, completing the program for the current fiscal year. Companies include:

West Australian Petroleum Pty. Ltd., which is to drill in Samphire Marsh in Western Australia; Santos Ltd., Cordillo Downs, Southern Australia; Australasian Petroleum Co. Pty. Ltd., Puri, Papua; Papuan Apinaipi Petroleum Co. Ltd., Kaufana, Papua; Associated Australian Oilfields NL, Karumba, Queensland; Clarence River Basin Oil Explorat on Co. NL, Pimba Southern Australia.

Australia To Expand Refining

Standard-Vacuum Oil Co. has awarded Fluor International SA, wholly owned subsidiary of Fluor Corp. Ltd., a two-phase contract which will permit Stanvac to raise the crude capacity of its Australia refinery by 25%. First phase of contract calls for substantial improvements to Standard's Altona refinery, which is located 15 miles from Melbourne. When finished, the refinery's crude capacity will be increased to 41,000 b/d from 32,000 b/d, accompanied by improvement in motor-gasoline and middle-distillate production. In the second phase, Fluor will engineer and construct a new Sovafiner to improve diesel-oil quality.

Engineering work has ben started on both projects. Construction will begin this July. Both units are scheduled for completion in 1959.

Aramco Completes Sour-Crude Wells

Arabian American Oil Co. has completed two wildcat wells in which oil was discovered last fall. Manifa No. 1 has been completed through perforations from 7,715 ft to 7,800 ft and from 7,810 ft to 7,865 ft in the Yamama formation, Lower Cretaceous. The well was drilled to total depth of 9,637 ft, and plugged back to 7,892 ft—first well to have discovered oil production in Aramco's concession area from the Yamama formation, which lies above the Arab, principal producing zone in Aramco's onshore fields. Manifa No. 1 crude is sour, with API gravity of approximately 26. Initial tests have indicated Yamama formation to be highly prolific in this well.

Khurais No. 1 has been completed for production from the Arab-D member and from the upper part of the Jubaila formation—both of Upper Jurassic. It was plugged back to 4,975 ft after reaching total 10,261 ft. Khurais No. 1 crude also is sour, with API gravity of approximately 33. Initial tests have indicated flowing rates of approximately 3,000 to 4,000 b/d.

Red China Ups Oil

Red China expects to double power and coal production, and triple petroleum output, by 1962—according to *International Energy Reports* on UN economic developments. Figures gathered indicate Red China increased power production to 19 billion kilowatt- hours in 1957, from 7.3 billion in 1952. Coal output rose to 123.9 million metric tons, from 63.5 million in 1952. Petroleum production increased to 1.44 million metric tons (28,800 b/d) last year, from 0.44 million (8,800 b/d) in 1952.

The Red Chinese say they expect to produce 44 billion kwh of power, and have an annual output of 230 million metric tons of coal and 5 to 6 million metric tons (100,000 b/d to 120,000 b/d) of petroleum by 1962. Figures indicate Red China exceeded its original power and coal target for 1957, but lagged in petroleum. Original 1957 target for petroleum production was 2.01 million tons—later revised to 1.50 million. As a result, China has had to step up oil imports from the Soviet Union. In 1953, mainland China has had to step up oil imports from the Soviet Union. In 1953, mainland China imported 6.4% of its total of 2.8 billion rubles worth of Soviet imports in the form of oil products; in 1956 such imports represented 11.7% of total imports of 2.9 billion rubles.

Veteran Saudi Arab employees of the Arabian American Oil Co. at work on a drilling rig near Abqaiq, Saudi Arabia. By end of last year, 72 Saudi Arabs had worked for company steadily for at least 20 years. Saudi Arabs today comprise about 70% of company's total employees in the country.

Atomic Tanker Plans In Japan

Hitachi Shipbuilding and Engineering Co. has disclosed a plan to embark upon a full-fledged research program for the construction of atomic-powered tankers with the close cooperation of Hitachi Seisakusho, Iino Marine Transportation, and Iino Heavy Industries. Their plan calls for the building of a 65,000 dwt oil tanker powered by a pressurized water reactor.

Hitachi Seisakusho will perform the research on the reactor. Hitachi Shipbuilding and Engineering and Iino Heavy Industries will design and construct the hull, while the Iino Marine Transportation Co. will study the aspects of payability.

Jordan Rights Granted Italian

Jordan government has approved exploration rights to Italian Nino Gugniasca. Concessions to the other two-thirds of the country already have been given to Edwin W. Pauley (USA) and George Zimeri (Guatemala). Mr. Pauley is the only one drilling. He has been exploring for a year without success.

BP To Enter Italian Market

British Petroleum Co. Ltd. has purchased distribution networks of the two Italian concerns SAROM and E. Garrone. The two owned more than 1,000 service stations and gasoline sale points mainly in North and Central Italy, as well as organization for marketing of all oil products. BP previously had been limited to ship bunkering and airport aviation-gasoline supply. Other BP products were marketed through the AGIP, partner of BP in the IROM refinery at Porto Marghera (Venice) since 1948. New operations will begin July 1958.

Japanese Refinery Bid In Bangkok

The Fuji Industrial Co. is considered to be a top contender for a contract to build a $20-million 5,000 b/d refinery near Bangkok, the Thailand capital. If it wins the contract, the Fuji firm would have its investment repaid by receipt of net profits acquired by the refinery beginning in its fourth year of operation.

Japanese Refining Curb

Major Japanese oil firms have agreed to restrict the refining of crude for domestic use to 244,000 b/d. The period of restriction is expected to be enforced very shortly. The 244,000-bbl rate, however, is only 10,000 bbl less than present daily processing volume, and is not expected to remedy the current oversupply situation.

C. O. Tongberg

Jersey Production Research's President

Officers and directors of the Jersey Production Research Co., newly formed exploration and production research affiliate of Standard Oil Co. (New Jersey), have been announced. The new affiliate will direct the geological, geophysical, and production research activities for Jersey Standard domestic and foreign affiliates which previously had been carried out under contract by The Carter Oil Co., Tulsa, Okla. The work will be carried forward in the present laboratories at Tulsa with a staff of 400 men and women who are being transferred from Carter Oil to the new company.

President and a director of the Jersey Production Research Co. is Dr. Carl O. Tongberg, formerly a vice president and director of Carter Oil in charge of research. Vice presidents and directors are Max C. Sons and R. C. Curtis, also formerly of Carter. Other directors are M. A. Wright and Nelson Y. Ruth, both of Standard Oil Co. (N.J.); O. C. Wheeler, International Petroleum Co. Ltd.; W. D. C. Mackenzie, Imperial Oil Ltd.; Guillermo Zuloaga, Creole Petroleum Corp.; Carl G. Herrington, Carter Oil Co.; and Dr. Charles L. Fleming, Esso Research and Engineering.

Continental Acquires Buffalo

An agreement has been reached under which Continental Oil Co. will acquire both the producing properties and the nonproducing acreage of Buffalo Oil Co., Tulsa, Okla., it has been announced by L. F. McCollum, president of Continental, and H. P. Taubman, chairman of Buffalo. Most of the properties of Buffalo are located in Oklahoma, Texas, New Mexico, and Louisiana.

ALCO Elects Egbert & Morris

ALCO Products Inc. has announced election of Perry T. Egbert as chairman and William S. Morris as president. Mr. Egbert has been president of the company, and Mr. Morris executive vice president. The board's action is effective immediately. Mr. Egbert and Morris had held their former offices since December 1, 1952. Both are career ALCO executives.

Kellogg's Plants for Profit

A new division of industrial projects has been established by M. W. Kellogg Co., New York, with J. M. McAneny as director. Purpose of the new division is to broaden Kellogg's international contracting services long available to the petroleum and petro-chemical industries. Any process industry which approximately parallels a petroleum refinery will now be able to utilize Kellogg's organization which, under one corporate management, makes available in depth all of the three major contracting services—engineering, procurement, and construction.

J. M. McAneny

Introduction of the new expanded activity will be backed by a promotion program—titled "Planning the New Plant for Profits"—aimed at leaders of industry who make decisions governing capital investments. Kellogg believes a superior coordinated contracting service not previously available to many industries—especially the small-scale organization—plus its willingness to assume complete responsibility for executing capital investments, will encourage many firms to execute their capital expansion programs in 1958.

1900 OR BOX TYPE

highest quality fittings for refinery and chemical plants

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GRAND HALL
ROW 'D' GROUND FLOOR

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CHEMICAL & PETROLEUM ENGINEERING EXHIBITION
OLYMPIA 18-28 JUNE 1958

Lake & Elliot Ltd.
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Dowell Inc. Now A Dow Chemical

On May 31 Dowell Inc., a wholly owned subsidiary of The Dow Chemical Co., became a division of Dow, following a meeting of the Dowell and Dow boards in Midland, Mich., May 5 and 6. There will be no changes in the present management of the new division, and all operations of the large service organization will continue to be directed from the general offices in Tulsa.

It is planned that the company's long established operations in Canada will be handled through a new Dow subsidiary. Dowell Latin American subsidiary, United Oilwell Service SA, will also become a Dow subsidiary. Both companies will report through the new Dowell division.

Dowell was organized by Dow in 1932 to handle the newly developed Dow process for stimulating oil, gas, and water wells with chemicals. More than 50 different Dowell services are now available to the petroleum and other industries. These also include chemical cleaning services for various kinds of industrial equipment such as boilers, condensers, and piping. Dowell, with more than 2,000 employees, has offices and service headquarters in approximately 160 places in the United States and Canada. Extensive laboratories, shops, and equipment assembly facilities are also located in Tulsa.

Holden New Harrisburg VP

Robert C. Holden has been named vice president and general manager of Harrisburg Sales & Service Inc. Mr. Holden will make his headquarters in Houston, location of the company's manufacturing facilities. Harrisburg Sales & Service Inc. manufacturers and markets Diamond Hard products and oil-field specialties—including liners, piston rods, pistons, and accessories for all oil-field pumps.

J. B. O'Connor, president of Dresser Industries Inc., on the occasion of his receiving the honorary degree of doctor in commercial science from St. Bonaventure University, Olean, N. Y.: Making the presentation on behalf of the university is the Very Reverend Brian Lhota, OFM, St. Bonaventure's president.

J. B. O'Connor Honored

In a fervent plea for greater American investments abroad, John B. O'Connor, president of Dresser Industries Inc., asserted that "private American capital should finance and build the dams, the steel mills, the communications systems, and the factories which other nations need to improve their living standards," in an address on the occasion of his receiving the honorary degree of doctor in commercial sciences from St. Bonaventure University, at Olean, N. Y.

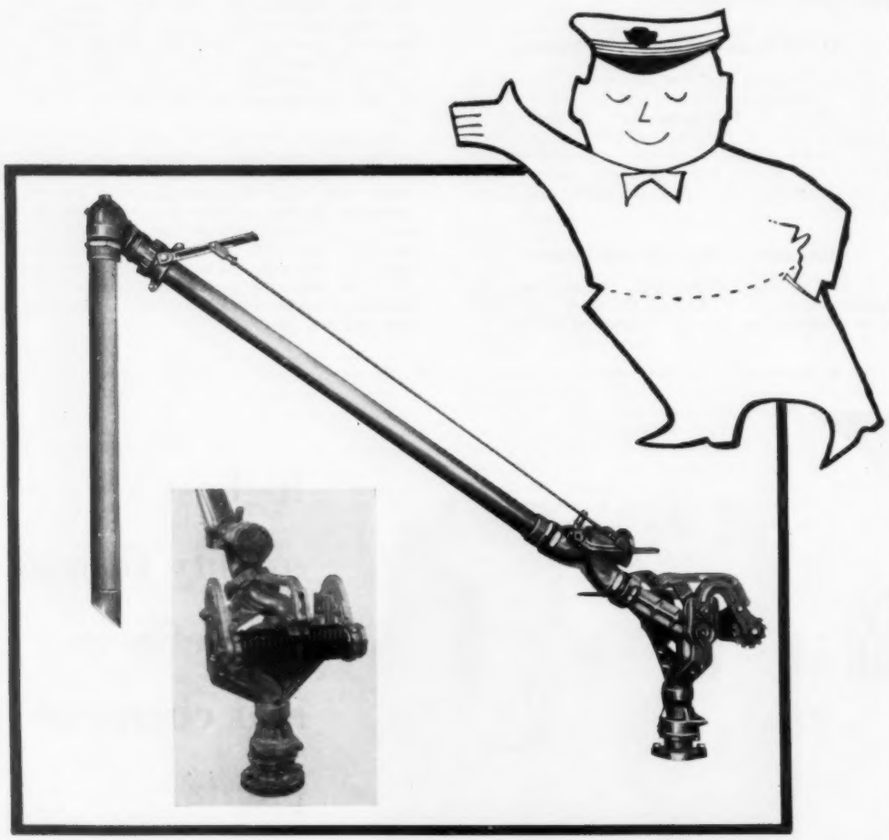
Mr. O'Connor also expressed his firm belief that "United States industrialists should pool their resources to establish a central research institute—similar to the Soviet Academy of Sciences—through which would be funneled all the technical and scientific data available in the world." The Dallas industrialist asserted that only by this means can we "retain technical superiority and compete with the science and research of the Soviet Union and its satellites.

In regard to the need for greater American investments abroad, and a more flexible foreign-trade policy on behalf of American businessmen, Mr. O'Connor pointed out that "We must have men with imagination—who think not only in dollars—but who learn to trade in all currency—whether it be money, marbles, or chalk." "In doing so," he said, "we can build up the buying power of other countries—and create a market favorable to ourselves." He told his audience: "It is too easily forgotten that, in the infancy of our own great republic, it was the investing of foreign capital that built the United States into a first-class power. Our national memory is short. Europe, already industrialized for generations, gave us the technical know-how to create our vast industrial complex—and dug deep into her own wealth to finance these early American business endeavors. It was pounds, francs, marks, and guilders, that built our railroads, our power systems, and our foundries. Without these, the United States might still be no more than a third-class agricultural nation."

SONJ Ups Executive Membership

Board of Standard Oil Co. (New Jersey) has increased to six, from five, membership of its executive committee—with Leo D. Welch, a vice president, the additional member. Committee meets daily to act for the board when the latter is not in session, and is available for assistance to the company's chief executive officer.

To emphasize the nature of their duties—which include assumption of the chief executive officer's responsibilities during his and the president's absence—Mr. Welch and three other former vice presidents were designated executive vice presidents. They are Hines H. Baker, L. W. Elliott, and E. E. Soubry. All four will serve with Eugene Holman, chairman, and M. J. Rathbone, president.



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CHEMICAL & PETROLEUM ENGINEERING EXHIBITION
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Ira S. Boydstun

Boydstun Joins Chemical Construction

Ira S. Boydstun has been appointed manager of a new Gulf Coast-Southwest area office in Houston for Chemical Construction Corp. Engaged in process design and sales for over 20 years, and a pioneer in purification of petroleum and distillates, Mr. Boydstun has taken an active interest in the work carried on by the API Committee on Disposal of Refinery Wastes and is a member of the Air Pollution Control Assn., American Institute of Mechanical Engineers, and the Houston Engineering and Scientific Socy. He was formerly sales manager for Petreco.

Am. Maracaibo to Change Name

At annual meeting American Maracaibo Co., May 20, stockholders will vote on proposal to change company's name to Felmont Petroleum Corp. George J. Sallee will be nominated a director, to fill a board vacancy. He has been vice president in the company's subsidiary, Felmont Oil Co., since 1947. Since 1955 he has been a vice president of American Maracaibo.

Import Program 98.4% Effective

Captain M. V. Carson, new director of the Office of Oil and Gas, Department of the Interior, said "The voluntary program has been 98.4% effective" —reviewing the history of the voluntary imports program and the various high-level committees which have been established by the federal government.

Sunray-Suntide to Merge

Directors of Sunray Mid-Continent Oil Co., Tulsa, and Suntide Refining Co., Corpus Christi, Texas, have announced a proposed merger of Suntide into Sunray on or about September 1. Merger agreement, subject to stockholder approval, would contemplate an exchange of one share of Sunray Mid-Continent for four shares of Suntide which was organized in February 1952. Sunray Mid-Continent has from inception of Suntide owned approximately 50% of the 3,125,000 shares of Suntide common stock outstanding at December 31, 1957.

Carson Director of Oil & Gas

Captain Matthew V. Carson, Jr., USN, has been appointed director of Interior Department's Office of Oil & Gas—having served since July 29, 1957 as administrator of the voluntary oil import program. He succeeds Hugh A. Stewart, retired as of February 28, 1958. Captain Carson will serve as principal oil and gas staff advisor to the Secretary of the Interior—responsible for coordination of federal petroleum and gas activities assigned to the office. He will continue to administer the voluntary oil import program.

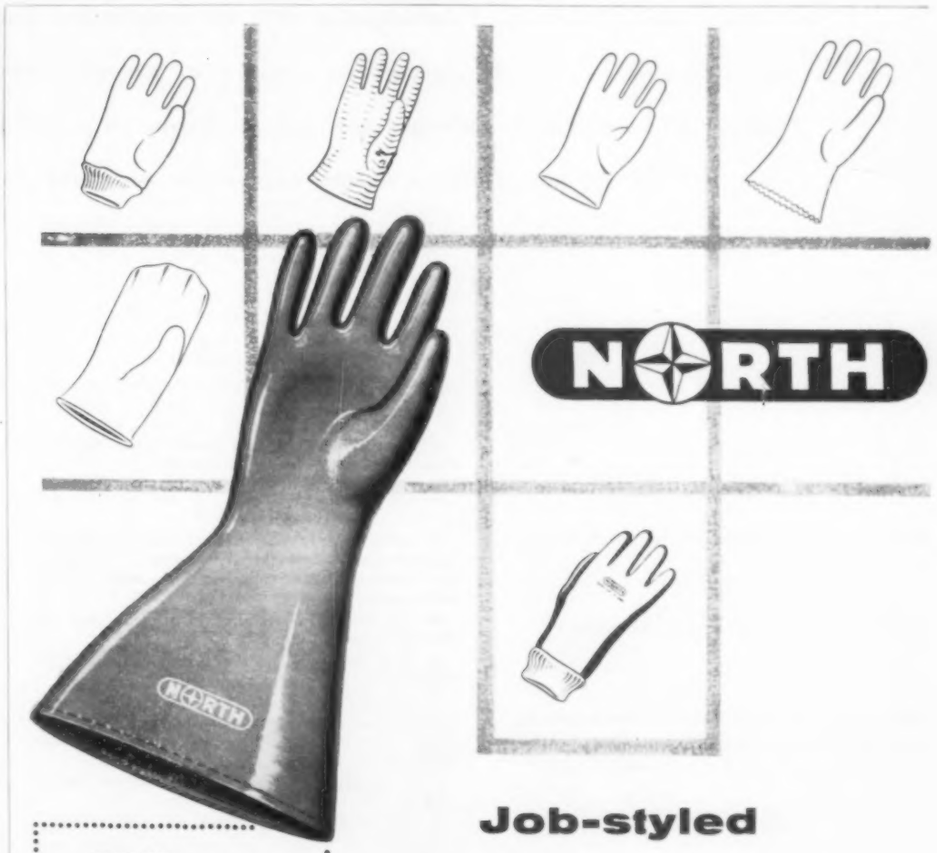
Formerly Captain Carson had been on active naval service; from 1940 legal officer of the 3rd Naval District, in New York. He also served with the Joint USA Military Group in Spain. Associated from 1951-53 with the Naval Petroleum Reserve—first as counsel, then as director—he also served with the 6th Fleet in the Mediterranean, and with the Munitions Board. During World War II he commanded four destroyer escorts, and participated in four major campaigns in the South Pacific.

'Chemetron' New Name for NCG

National Cylinder Gas Co. has announced the company name will be changed, because it has been "outgrown," and stockholders are being asked to approve the name "Chemetron Corporation." President Charles J. Haines made the announcement at a Chicago press conference viewed on closed-circuit television by additional newsmen and businessmen at two locations in New York. He said the 24-year-old "National Cylinder Gas Co." name had been satisfactory while the firm produced only industrial gases and equipment using gases, but that addition through the years of many new product lines and services had made it "too restrictive."

Mr. Haines said the name finally selected by the board of directors "won every test conducted by two research organizations. 'Chemetron' is appropriately made up of parts of the names of three of the many major industries served by the company—chemicals ('chem'), metals ('met') and electronics ('tron')." The company and its subsidiaries have 81 plants located in 31 states, and 14 plants in other countries.

National Cylinder Gas Co. is a leading producer of industrial and medical gases; welding and cutting equipment; medical equipment, welding fittings and flanges for piping systems; customs forgings; continuous processing and container filling equipment for the food and other industries; industrial dielectric heating apparatus; specialty catalysts, colors and other chemical products.



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IPAC concession sets trend in Iran

In a surprise move, Standard Oil Co. (Indiana) has signed a new contract of major importance over 6,178 square miles in Iran. The contract establishes a new concept of bonus payment plus equal participation with the government. From the company's point of view, this is a 50-50 arrangement wherein its partner contributes its share of development costs, but it increases government sharing in profits far over the traditional 50%. In view of the contract's unique importance, it is here given in its original text.

AGREEMENT

between

PAN AMERICAN PETROLEUM CORPORATION

and

NATIONAL IRANIAN OIL COMPANY

for

The Joint Exploration and Development of a 16,000 Square Kilometer Area in the Northern Part of the Persian Gulf

THIS AGREEMENT is concluded between the NATIONAL IRANIAN OIL COMPANY hereinafter referred to as First Party and PAN AMERICAN PETROLEUM CORPORATION, a Company incorporated under the laws of the State of Delaware, United States of America, hereinafter referred to as Second Party.

WHEREAS First Party desires to expand the production and export of Iranian petroleum, thereby increasing the benefits accruing to Iran, and to accomplish the said result with all possible expedition;

WHEREAS First Party is authorized by the Petroleum Act of July 31st, 1957 to enter into Agreements of this nature;

WHEREAS Second Party has the capital, technical competence, and management skills necessary for carrying out the operations hereinafter specified, and in particular the requisite market outlets for the sale of such petroleum as may be discovered as a result of the said operations;

WHEREAS the Parties intend that the provisions of this Agreement shall be carried out in a spirit of good faith and good will,

NOW, THEREFORE, it is hereby agreed between First Party and Second Party, as follows:

ARTICLE 1

Unless the context otherwise requires, the following definitions of certain terms hereinafter used in this Agreement shall apply for the purpose of this Agreement.

A. Agreement means this instrument and the Schedule attached hereto.

B. First Party means the National Iranian Oil Company, or any successor thereto.

C. Second Party means Pan American Petroleum Corporation, or any person to whom a transfer is made in accordance with the provisions of this Agreement.

D. Petroleum Act means the Petroleum Act of July 31, 1957.

E. Petroleum means crude oil and natural gas.

F. Crude oil means crude petroleum, asphalt and all liquid hydrocarbons in their natural state or obtained from natural gas by condensation or extraction.

G. Natural gas means wet gas, dry gas, all other gaseous hydrocarbons produced from oil or gas wells and the residue gas remaining after the extraction of liquid hydrocarbons from wet gas.

H. "Internal consumption in Iran" means the consumption within Iran of petroleum, petroleum products or incidental substances in contrast to their export from Iran.

I. "Posted Price" means the f.o.b. price published for each grade, gravity and quality of Petroleum offered for sale to buyers generally for export at the relevant point of export, which price shall be a price established with due regard to any posted prices for Petroleum of comparable grade, gravity and quality which may have been published previously in respect of the relevant point of export.

J. "Petroleum operation" means every producing, transportation or sales operation authorized by this Agreement.

K. "Cubic meter" means one cubic meter at sixty degrees Fahrenheit and at normal atmospheric pressure.

L. "Effective Date" means the date on which the Act approving this Agreement has received the royal assent and for the purposes of this Agreement any reference in the Petroleum Act to the date of the agreement shall be understood to be a reference to the Effective Date.

M. "Land" means any land whether submerged or not.

N. "Fixed Asset" means any asset erected, installed or constructed, permanently affixed and to be used directly in the conduct of operations hereunder.

O. "Taxation Period" means a calendar year of twelve months commencing on January 1st of each year respectively or such other period as may be agreed to between the Parties and approved by the Ministry of Finance of Iran.

P. "Area" means the entire area referred to in Article 3 Section 1 of this Agreement or any part or parts thereof in which the operation authorized by this Agreement may be conducted from time to time.

ARTICLE 2

1. First Party and Second Party do hereby mutually enter into a joint structure relationship, which as contemplated by the Petroleum Act, does not constitute a separate juridical personality.
2. Except as otherwise provided herein and in the Petroleum Act, the parties hereto shall participate equally in and under said joint structure relationship. First Party and Second Party sometime in this Agreement are referred to collectively as "the Parties hereto" or as "the joint structure."
3. All Petroleum produced hereunder from the Area and all equipment, machinery, casing and other property purchased or obtained hereunder at the expense of the joint account of the parties hereto shall be owned, and all costs and expenses required for operations hereunder (except those costs and expenses which Second Party alone is required to contribute and pay for exploratory operations) shall be contributed and paid, by the parties hereto, fifty per cent (50%) by First Party and fifty per cent (50%) by Second Party. Each Party shall have the right to call for the delivery in kind, to it or its nominee, of its share of the Petroleum.

Article 3

1. An Area as described in Schedule A hereof is placed exclusively at the disposal of the joint structure to exercise therein the operations authorized by this Agreement through the agency of Iran Pan American Oil Company, a corporation to be formed by the Parties hereto, as hereinafter provided in Article 5 hereof.
2. At the end of the fifth year from the Effective Date, the total area mentioned in Section 1 of this Article shall be reduced by 25%. Thereafter within a maximum further period of five years, the Area shall be reduced again by 25%.
3. The area excluded to arrive at the reduction prescribed in Section 2 of this Article shall consist of blocks of not less than two hundred square kilometers each with an average length of not more than six times their average width.
4. Not less than one month in advance of the return of parts of the Area as provided for in Section 2 of this Article, Second Party shall furnish to First Party a description of the boundaries of the part to be returned.
5. If at the end of the twelfth year from the Effective Date Second Party shall not have achieved commercial production in the Area within the meaning of this Agreement the same shall be returned to First Party.
6. If at the end of the twelfth year from the Effective Date commercial production has been achieved, only lands on which commercially exploitable fields shall have been discovered shall remain at the disposal of the Parties hereto.

Article 4

Within thirty days after the Effective Date, Second Party shall file an application for registration with the Iranian Registration Department in compliance with Iranian Law and regulations concerning the registration of Companies.

Article 5

1. Within sixty days after the Effective Date of this Agreement, the Parties hereto shall constitute and register with the Iranian Registration Department, a Joint-Stock Company which shall be a non-profit corporation and which shall carry out, for the joint account and as agent of both Parties, the operations herein specified; it being understood, however, that in carrying out and performing the exploratory operations herein made binding on Second Party, said corporation shall act as agent of Second Party only. The name of the said Joint-Stock Company shall be Iran Pan American Oil Company and shall be referred to hereinafter as "IPAC". The nationality of IPAC shall be Iranian and it shall be subject to the provisions of the Iranian Commercial Code in respect of any matter not provided for in its Statutes.
2. IPAC, acting as agent of both Parties hereto or as agent only of Second Party, as the case may be, shall perform and carry out all operations required or permitted hereunder; and the Parties hereto shall pay all the costs and expenses required for such operations, jointly or individually as required by the terms of this Agreement, through the agency of IPAC. The Parties hereto from time to time may authorize contracts to be made in the name of IPAC, in each of which the contractor shall be the agent of the joint structure or of Second Party only, depending on whose obligation is being performed under said contract.
3. The costs and expenses required for equipping, staffing, maintaining and operating the office or offices of IPAC shall be allocated on a fair and equitable basis, in accordance with good accounting practices, between the Parties hereto respectively according to the operation or operations from time to time being served; and the Parties hereto shall bear and pay their respectively allocated shares thereof. Without limiting the generality of the foregoing, the costs and expenses referred to in this Section 3 shall include salaries and wages of employees of IPAC and of employees lent on a temporary, part-time or permanent basis by one of the Parties hereto to IPAC, the cost of employee vacations, sickness, medical, hospital, pension, thrift, savings and stock bonus and other employee benefit plans to IPAC or to the Party hereto lending such employees, the amounts paid to contractors and the amounts charged by either or both of the Parties hereto for the services of any of their respective departments, said services to be performed only under written contracts with IPAC with the approval of both Parties hereto.
4. All payments made by each Party hereto to, for or through IPAC for and on account of the costs and expenses referred to hereinabove provided in Article shall, in addition to any and all other deductible items, be deductible items of expense in the computation of such Party's net income under the applicable Iranian Income Tax Law.

Article 6

1. Each of the Parties hereto shall subscribe and pay for half of the capital stock of IPAC. The equal participation of the Parties hereto in IPAC shall be reflected in the management of the said Company. Accordingly, half the members of the Company's Board of Directors shall be nominated by First Party and half by Second Party. The selection of a Chairman, a Vice Chairman and a Managing Director from among the members of the Board shall be effected in the manner laid down in the Company's Statutes, it being understood that said Chairman shall be a Director nominated by First Party and said Vice Chairman and said Managing Director shall be Directors nominated by Second Party.
2. The Audit Board shall consist of one auditor to be nominated by each Party, and a third auditor, who shall act as President of the Audit Board, to be nominated by the President of the Schweizerische Kammer fur Revisionswesen of Zurich from among nationals of any country other than Iran and the United States of America.

Article 7

1. In order to ensure the continuity of the corporate activity of IPAC each Party agrees to deposit with the Union de Banques Suisses, Zurich, a number of shares of IPAC equal to one per cent of the said Company's capital. The deposit shall be effected under the joint signature of the Parties and on the basis of a joint and irrevocable mandate, the duration of which shall be the same as the duration of this Agreement.
2. The mandate referred to in Section 1 of this Article shall contain the following provisions:
   a) If the Union de Banques Suisses relinquishes or in any other manner terminates the mandate, it may nominate as a substitute to itself another Bank of equal importance.
   b) The Bank holding the mandate shall undertake to deliver the admission card for each General Meeting, in respect of the shares deposited with it, to a person who shall be nominated in advance for each year before the 31st December of the preceding year. The said person shall be nominated by mutual agreement between First and Second Parties, or, failing such agreement, by the President of the Tribunal Cantonal of Geneva, who shall choose the said person from among nationals of a third country, it being understood that he should have no interest in a petroleum undertaking nor be an official of any Government, including local government and municipalities;
   c) The person thus designated to vote shall exercise his mandate with strict regard to the interests of IPAC, within the framework and the spirit of this Agreement.
3. Failing the acceptance of the Union de Banques Suisses or the nomination of a substitute by the said Bank, the Bank to receive the deposit shall be designated by mutual agreement or, failing such agreement, by arbitration.

Article 8

1. The initial authorized capital of IPAC shall be Rials 7,500,000 (seven million five hundred thousand rials). This capital may be increased from time to time, as necessary, in the manner prescribed in IPAC's Statutes.
2. Fifty per cent of the initial capital mentioned above, as well as of any increases thereto, shall be provided by First Party or any Company or Companies fully owned by it, and fifty per cent shall be provided by Second Party or any Company or Companies fully owned by it. Fully owned Company in relation to either Party means a Company all the voting shares of which are owned by that Party or by a parent of that Party.

Article 9

1. As and when, in addition to the original capital of IPAC and any subsequent increases thereof, supplementary funds shall become necessary, First and Second Parties shall each furnish half of the sum required. Should they be unable to do so, IPAC shall secure the funds thus becoming necessary either by raising a loan with or without issue of debentures or by some other method agreed upon by the Parties hereto.

Article 10

1. IPAC, as agent of the Parties hereto or, where applicable, as agent of Second Party, is hereby authorized and given the exclusive right to conduct and manage Production and Transportation Operations as authorized by this Agreement in and in respect of the Area.
2. Production Operations shall include: the exploration for Petroleum by geological, geophysical and other methods, including drilling for the purpose of determining geological conditions; the drilling for Petroleum; the production and taking of Petroleum; the storing of Petroleum; and all other functions normally associated with producing operations.
3. Transportation Operations shall include: the conveyance of Petroleum from producing fields to refineries, to distribution facilities, to other transportation facilities or to seaboard and from refineries to any such points; the storing of Petroleum; and the delivery of Petroleum produced from the Area by any means, including loading on board ship.
4. IPAC, as agent of the Parties hereto or, where applicable, as agent of Second Party, shall have, to the extent that the following activities are incidental to the carrying out of any of the operations authorized by this Agreement, the right to reclaim land and create islands and to dig, sink, drill, construct, erect, lay provide, operate, maintain and administer pits, shafts, walls, trenches, excavations, dams, drains, water-courses, plants, tanks, reservoirs, and other storage facilities, topping plants, casing-head gasoline plants, sulphur plants and other facilities for producing and processing petroleum, pipelines, pumping stations, power houses, power stations, power lines, telegraph, telephone, radio and other communications facilities, factories, warehouses, offices, houses, buildings, ports, docks, harbours, piers, jetties, dredgers, breakwaters, submarine loading lines and other terminal facilities, vessels, conveyances, railways, roads, bridges, ferries, airways, airports, and other transport facilities, garages, hangers, work-shops, foundries and repair shops and all other ancillary services in the opinion of the Parties hereto or, where applicable, of Second Party for the purposes of or in connection with operations hereunder, and all such further or other rights as are or may become necessary or reasonably incidental to the carrying out of any of such operations. Any such facilities may be located by the Party concerned at such place or places as it may determine, provided that:
   a) Where such facility is to be located outside the Area, its location shall be determined after consultation between the Parties hereto, due regard being given to considerations of maximum economy and efficiency of operations and,
   b) the reclaiming of land, the creation of islands and the construction of any railway lines, ports, telephone, telegraph and wireless services and aviation facilities in Iran shall require the prior consent in writing of the Iranian Government which consent shall not be unreasonably withheld or delayed.
5. The Parties hereto, acting through IPAC, jointly shall determine and have full exclusive and effective management and control of all the operations authorized hereunder subject to the provisions of this Agreement, except exploratory operations, including exploration drilling, as to which operations Second Party, acting through IPAC, shall,

subject to the provisions of Article 12, determine and have full, exclusive and effective management and control.

Article 11

In order to expedite the performance of operations authorized hereunder, IPAC and/or Second Party may, without in any way diminishing the responsibility of the Parties hereto to Iran, engage such contractors fulfilling the requirements of Article 4 of the Petroleum Act as they may see fit for the purpose of carrying out any of the operations and functions authorized under this Agreement, and for the purpose of Article 3 of the Petroleum Act the agreement of First Party to any such engagements is hereby granted.

Article 12

1. Second Party, acting through IPAC, shall be subject to the following obligation with respect to exploratory operations including exploration drilling:
   a) To exert its utmost efforts to explore the Area to the maximum extent consistent with good petroleum industry practice;
   b) To prepare the plan of its operations in consultation with First Party, and to carry it out dilligently and at its own expense, any cost of utilization of land being part of such expenses;
   c) To submit to First Party a detailed progress report on the work done as well as a comprehensive final report;
   d) To enable representatives of First Party to inspect at all reasonable times its operations under this Agreement;
   e) To carry the entire burden of the expenses of exploration, namely, First Party's share as well as its own, in the event that exploration operations should fail to establish the existence of petroleum reserves capable of commercial production;
   f) To observe the provisions of Sections 2, 3, 5, 7 and 8 of Article 13.

Article 13

The Parties hereto, acting through IPAC, at their joint cost and expense shall be subject to the following obligations:

1. To exert their utmost efforts to develop any discovered fields to the maximum extent consistent with good petroleum industry practice; to extract such petroleum as shall be discovered at a rate ensuring that such part of the discovered reserves as may be economically extracted by the utilization of the most up-to-date methods and practices of the petroleum industry shall be fully extracted during the term of the Agreement; and in particular to observe sound technical and engineering principles in conserving the deposits of hydrocarbons and in general in carrying out the operations authorized under this Agreement;
2. To maintain full records of all technical operations performed under this Agreement;
3. To keep the account of their operations in such a manner as to present a fair, clear and accurate record of the cost of such operations, and for this purpose to adopt a suitable accounting system and revise the same from time to time in the light of future development;
4. To enable representatives of each other to inspect at all reasonable times the operations carried out under this Agreement, and all measuring apparatus and means of measurement and testing;
5. To minimize the employment of foreign personnel by ensuring so far as reasonably practicable that foreign personnel are engaged only to occupy posts for which IPAC and, where applicable, Second Party do not find available Iranians having the requisite qualifications and experience;
6. To prepare plans and programs for industrial and technical training and education, and to cooperate in their execution with a view to ensuring the gradual and progressive reduction of foreign personnel in such manner that upon expiry of ten years from the Effective Date the number of foreign nationals employed by IPAC shall not exceed two percent of the total personnel employed by it, and the top executive positions occupied by non-Iranians shall not exceed 49% of the total of executive positions available;
7. To be always mindful, in the conduct of their operations, of the rights and interests of Iran.
8. To ensure that each of them shall obtain through the medium of IPAC as agent, as and when it may so require and within a reasonable time, any information in the form of accurate copies of maps, sections and reports as shall be in final form and relate to topographical, geological, geophysical, drilling, producing and other similar matters relating to the operations authorized under this Agreement, as well as all important scientific and technical data resulting from their operations.

Article 14

1. Any plans, maps, sections, reports, records, scientific and technical data, and any other similar information relating to technical operations of Second Party or IPAC under this Agreement shall be treated by First Party, Second Party and IPAC as confidential in the sense that their contents or effect shall not be disclosed by either Party or IPAC without the consent of the Parties hereto, such consent not to be unreasonably withheld or delayed.

Article 15

1. The criterion for determining the time at which the exploration stage of operations comes to an end shall be the completion of a "Field Discovery Wildcat" according to the definition given thereof by Frederic H. Lahee. The tests leading to the conclusion that such field discovery wildcat has been completed shall be carried out in the presence of a representative of both the Parties hereto.
2. As soon as Second Party comes to the conclusion that its exploration operations have resulted in the discovery of a petroleum reserve capable of commercial production, it shall submit a detailed report on its conclusion to First Party.
3. Second Party's report to be submitted to First Party under Section 2 of this Article shall clearly set out:
   a) The depth, pressure and other characteristics of the reservoir; its size and potential productive capacity; the daily potential productive capacity of each well; the physical characteristics of the petroleum discovered;
   b) The distance and accessibility of the reservoir from the seaboard and major points of distribution or consumption; the availability of transport facilities to market outlets, or the cost of creating or completing such facilities;
   c) Any other relevant facts relied upon by Second Party and conclusions drawn therefrom;
   d) Opinions expressed by the expert or experts charged with exploration operations.
4. First Party shall examine Second Party's report promptly and in all good faith with a view to determining whether a commercially exploitable field within the meaning of this Agreement as defined in Section 5 of this Article has or had not been discovered.
5. A discovered petroleum reserve shall be regarded as commercially exploitable only if the quantity of petroleum reasonably foreseen as derivable therefrom is such that delivery of petroleum at the seaboard shall be possible on the following basis: if the cost of production is increased by transport and loading charges, as well as a sum equal to 12-½% of the applicable Posted Price for petroleum of similar quality, and if the resultant figure is deducted from the said Posted Price, there should be left a net profit of not less than twenty-five per cent of the applicable Posted Price.
6. If First Party concludes that Second Party's finding to the effect that a commercially exploitable field has been discovered is not justified, it shall inform Second Party of its views and the reasons therefor. Thereupon Second Party may undertake further drilling, and if the result of such further drilling confirms the existance of a field capable of commercial production, all expenditure incurred subsequently to the completion of the field discovery wildcat shall be considered as development and exploitation expenditure and shall be reimbursable to Second Party by the joint structure through IPAC.
7. The provisions of this Article shall apply in respect of any field discovered subsequently to the first field.
8. As soon as the existence of a field capable of commercial production as defined in Section 5 of this Article has been proved, the Parties hereto jointly shall assume the responsibility for all expenditure subsequent to the completion of the Field Discovery Wildcat, required for the development and exploitation of the field. All expenditure effected up to that date for exploration in any part of the Area shall thereupon become automatically repayable to Second Party by the joint structure through IPAC.
9. After discovery of the first field, Second Party shall advance through IPAC the exploration expenses necessary for work on other fields within the Area. The aforesaid expenses shall be refunded to Second Party after the completion of a new "field discovery wildcat" or, failing such completion, after the expiry of the entire exploration period of twelve years.
10. In fulfilment of the repayment obligations laid down in this Article, the joint structure, through IPAC, shall credit the account of Second Party with a sum equal to the exploration expenses, on the basis of debit notes which Second Party shall send to IPAC within two months next following each quarter. IPAC shall be entitled to control and verify the accuracy of such debit notes and to demand vouchers in support thereof. Upon expiry of forty-five days from the date of submission of a debit note, if no objection shall have been raised thereto, it shall become conclusive.
11. The payment to Second Party of sums credited in accordance with this Article to Second Party's account shall be effected by the Joint structure, within the shortest possible time, and in any case by annual installments amounting to not less than the equivalent of ten cents per barrel of all petroleum exported.
12. Fifty per cent of the sums paid to Second Party in repayment of exploration expenses shall be paid by Second Party to First Party.

Article 16

1. Exploration operations shall commence not later than six months after the Effective Date.
2. Drilling shall be commenced and continued with all reasonable speed in accordance with good petroleum industry practice; but Second Party shall in any case have commenced, within a maximum period of eighteen months after the Effective Date, the drilling of at least one well for petroleum in the Area entrusted to the joint structure under this Agreement.
3. If at the end of twelve years after the Effective Date, Second Party shall not have achieved commercial production in the Area entrusted to the joint structure under this Agreement, the present Agreement shall become null and void and IPAC shall be liquidated.

Article 17

1. IPAC as agent of the Parties hereto or, where applicable, as agent of Second Party, shall have the right to the exclusive use, without charge, of any unutilized lands belonging to the Government which may reasonably be required for use in connection with the operations authorized by this Agreement; provided, that the use of such land shall require the previous consent in writing of the Government, which shall be applied for through First Party and shall not be unreasonably withheld or delayed.
2. In cases where IPAC in such capacity needs, for use in connection with its operations under this Agreement, utilized land which belongs to the Government, acquisition of such land shall be made upon payment of a reasonable price or rental to the Government. Application to the Government in regard to such acquisitions shall be made through First Party.
3. Where land required by IPAC in such capacity is privately-owned, its purchase or lease shall be effected by direct negotiation with the owner. IPAC may, however, request First Party to in-

tervene and assist in such negotiation by applying the procedure of land acquisition prescribed in the Statutes of the National Iranian Oil Company.

4. Any reductions in the Area of this Agreement in accordance with Article 3 shall not affect any rights acquired under this Article 17 over lands so relinquished.

Article 18

If IPAC, as agent of the Parties hereto or, where applicable, as agent of Second Party, under this Agreement, reasonably requires for its operations any rights in or over land, less than a right to the exclusive use of land whether inside or outside the Area, such as easements, rights of way, way-leaves and the right to lay or pass on, over or under land any roads, railways, pipes, pipelines, sewers, drains, wires, cables, lines or similar objects, it shall give First Party notice in writing to this effect. First Party shall obtain for IPAC in such capacity the rights needed, gratuitously in the case of land mentioned in Section 1 of Article 17 and against payment of a reasonable price or rental in other cases. Payments thus incurred by First Party shall be reimbursed to it by the joint structure, with equal contribution by each Party.

Article 19

1. IPAC, as agent of the Parties hereto or, where applicable, as agent of Second Party, may, for the purpose of its operations under this Agreement, use any water which it may find on or under lands utilized by it or lands belonging to the Government and not utilized by it, subject, in this latter case to the Government's consent which shall be applied for through First Party and shall not be unreasonably witheld or delayed. Such use shall be free of charge subject to any third party rights and also to any payments which may be customary.
2. If IPAC in such capacity should reasonably require to utilize water or lands other than those referred to above, it shall acquire such rights by direct negotiation. The price or rental to be paid for such rights shall be reasonable and shall not exceed the market price of similar rights in the general vicinity.

Article 20

For the purposes of its operations, IPAC, as agent of the Parties hereto or, where applicable, as agent of Second Party, may take, subject to any rights of third parties, from the lands which it uses and also from lands within the Area belonging to the Government but not used by the Government or by others, and may utilize, any kinds of soil, sand, lime, stone, gypsum and other buliding materials, subject to the payment of reasonable compensation to third parties who may suffer injury as a result of the said taking or utilization.

Article 21

1. Each Party shall exercise its utmost efforts in order to ensure the sale of the maximum possible quantity of petroleum economically justified.
2. The production and sale programme for each year shall be prepared by IPAC at least six months before the end of the preceding year, in accordance with the following provisions and in observing the order of priority established hereunder:
   a) IPAC, as agent of the joint structure, in carrying out the operations in Iran authorized by this Agreement, shall have the right to use, free of charge, the petroleum produced or manufactured hereunder to the extent that such use is appropriate and necessary;
   b) IPAC, as agent of the joint structure, shall deliver to First Party such petroleum as may be required for internal consumption in accordance with the provisions of Article 26;
   c) IPAC, as agent of the joint structure, shall supply to First and Second Parties such quantities of petroleum as they may require in fulfilment of their sales contracts, in accordance with the procedure laid down in Article 22;
   d) To the extent that petroleum in excess of the quantities necessary to meet the requirements specified in the preceding subsections a), b) and c) of this Section 2 is available, IPAC, as agent of the joint structure, shall meet any sales commitments which it may have as agent of the joint structure as a result of its experience of world markets.

Article 22

1. The determination of the quantities of pertoleum to be supplied to First Party and to Second Party as laid down in Article 21, Section 2(c) shall be effected in the following manner:
   IPAC shall bring to the notice of First and Second Parties its estimate of production prepared in accordance with Article 21 Section 2. Each Party may take from IPAC, as agent of the joint structure, one half of the quantity available for export and may purchase any part of the other half to the extent that the other Party may not elect to take the quantity available to it. If the Parties do not so elect to take and purchase the whole of the said quantity available for export on conditions mutually acceptable to them, IPAC, as agent of the joint structure, shall have the right to sell the quantity thus available to other purchasers on conditions not less favourable than those available to the joint structure.
2. At the end of every month the value of the takings of each Party shall be worked out by multiplying the volume of its takings during such month by the relevant posted price at the date of delivery less any discount mutually agreed on as per Article 25, Section 2. If the value of the takings of one Party happens to be more than the value of the takings of the other Party, the Party having taken more shall, within thirty days after the establishment of said values, pay to the other Party one half of the difference between the value of their respective takings as payment for the petroleum of the other Party taken by it. Such payment shall be effected in U.S. dollars or in sterling or such other currency as shall be acceptable to the payee.
3. Any quantity of petroleum sold by IPAC, as provided for in Section 1, of this Article, shall be considered as having been sold half for the account of First Party and half for the account of Second Party.

Article 23

During the exploration period, Second Party shall be entitled to utilize such petroleum produced within the area as it may require for its operations, against payment to First Party of half the cost price thereof.

Article 24

1. Petroleum produced from the Area shall be owned at the wellhead firstly fifty per cent (50%) by First Party and fifty per cent (50%) by Second Party.
2. The export of petroleum produced from the Area shall be exempt from customs duties and export taxes and shall not be subject to other taxes, charges or payments to any governmental authority in Iran, whether central or local.
3. First Party, Second Party, IPAC as agent of the joint structure, and their customers may freely export petroleum from Iran without the necessity of a license or other special formalities, save only such documentation and formalities as are described in Article 33 Section 6 of this Agreement.
4. Insofar as exports referred to in this Article and any imports and re-exports referred to in Article 33 are concerned, the exporter or importer may freely decide whether and with whom and to what extent the vessels, crews, cargoes and freight shall be insured.
5. Second Party will give preferential consideration to transportation of crude oil and products on Iranian flag tankers.

Article 25

1. The crude oil produced in the Area shall be sold or delivered at the posted prices which IPAC shall determine as defined in Article 1, and shall publish and bring to the notice of First Party; provided, however, that the said posted prices may be diminished by any discounts which may be determined in the manner laid down in Section 2 of this Article.
2. In cases where IPAC, as agent of the joint structure, considers it advisable to grant a discount from posted prices, the rate of discount shall be determined by a committee consisting of two Directors of IPAC chosen one by each Party. The discount to be granted to each purchaser shall be determined with due regard to the quantity to be supplied, the duration of the sale contract, the regularity of supply, the guarantee of payment and other conditions.

Article 26

1. IPAC, as agent of the joint structure, in any annual period commencing on any anniversary date of the Effective Date shall supply to First Party such quantity of crude oil produced and saved from hte Area as First Party may require for Internal Consumption in Iran provided that:
   a) Following the commencement of commercial production First Party shall give written notice to IPAC of its requirements for each quarter, each notice to be not less than six months prior to the commencement of the quarter during which First Party anticipates taking delivery of the crude oil;
   b) IPAC, as agent of the joint structure, shall not be required to supply crude oil to First Party to the extent that such crude oil is required by it in carrying out its operations;
   c) First Party shall not require IPAC, as agent of the joint structure, to supply crude oil in any annual period in quantities that are disproportionate to those required to be supplied by other operators engaged in similiar operations in Iran, and in any case such quantities shall not in any annual period exceed 10% of the joint structure's total production.
   d) IPAC, as agent of the joint structure, shall not be required, in order to supply First Party's requirements, to produce crude oil at a rate higher than the maximum efficient rate of production.
2. Crude oil required to be supplied under Section 1 of this Article shall be delivered to First Party by IPAC, as agent of the joint structure, at such point in or adjacent to the field of production as may be determined by IPAC. Title to crude oil delivered to First Party shall pass at the point where delivery is made and First Party and Second Party shall contribute equal quantities to such delivery.
3. First Party shall pay to Second Party for crude oil supplied by Second Party under Section 2 of this Article an amount equivalent to the cost price of Second Party's share thereof, plus a fee of fourteen cents per cubic meter. Such payments shall be made within fifteen days of the date of presentation by Second Party of a provisional bill therefor. Within three months after the end of each calendar year, Second Party shall adjust its billings for such calendar year in accordance with the final determination by IPAC of cost price and First Party shall thereupon be debited or credited with any difference, as the case may be, and settlement thereof shall be made within fifteen days of presentation of such debit or credit note.
4. The cost price mentioned in Section 3 of this Article shall be determined by allocating total operating costs in respect of the Area on a Cubic Meter basis in accordance with sound petroleum industry accounting practices.

Article 27

1. IPAC, as agent of the joint structure, shall deliver to First Party, free of any payment other than what is laid down in this Article, natural gas produced by it and required by First Party for internal consumption in Iran (including any requirements for manufacture in Iran of derivatives whether for internal consumption in Iran or for export) to the extent to which the joint structure has natural gas available for supply to First Party after meeting requirements for use in the course of operations authorized by this Agreement.
2. After fulfilling tthe requirements mentioned in Section 1 of this Article, IPAC, as agent of the

joint structure, shall supply to First and Second Parties such quantities of gas as they may require in fulfilment of any sales contracts that they may have concluded. The determination of quantities to be supplied to each Party shall be in accordance with the provisions of Article 22.

3. If after the requirements specified in Sections 1 and 2 of this Article have been met any further quantities of natural gas remain available, IPAC, as agent of the joint structure, may take such gas for the purpose of fulfilling commitments entered into by it for export.
4. In the case of natural gas produced in association with crude oil, delivery to First Party shall be made at the field gas oil Separator, and in other cases delivery shall be made at such place in or adjacent to the gas field as IPAC may determine.
5. Where natural gas supplied or to be supplied to First Party is produced as an incident to the production of crude oil, the following provisions shall apply:
   a) If additional facilities are required for the purpose of enabling First Party to take delivery of the gas, the capital for such facilities shall be provided by First Party. Such additional facilities together with all facilities for production and delivery to First Party of natural gas shall be operated by IPAC.
   b) First Party shall pay Second Party IPAC's costs of delivery Second Party's share of the gas to First Party, including the costs of operating all facilities used for that purpose.
6. Where natural gas supplied or to be supplied to First Party is produced from a field which is primarily a producer of natural gas, the following provisions shall apply:
   a) If the gas produced from the field is solely for delivery to First Party, the latter shall provide the capital for any additional facilities required for development, production and delivery after the field has come into production. Such additional facilities together with all facilities for production and delivery to First Party of natural gas shall be operated by IPAC. First Party shall pay to Second Party IPAC's costs of producing Second Party's share of the gas and delivering it to First Party, including the costs of operating all facilities used for such production and delivery.
   b) If IPAC, as agent of the joint structure, and/or Second Party also take natural gas from the field, the entire operating costs shall be borne by those taking the gas, in proportion to their takings.

Article 28

1. First and Second Parties undertake to furnish each one half of the currencies necessary for the operations of the joint structure through IPAC.
2. Any sale by IPAC, as agent of the joint structure, of petroleum produced from the Area and destined for export shall be effected in world markets in currencies acceptable to First and Second Parties and quoted by the Banque Mellie, Iran. Any such sale may also be effected in a currency acceptable to one but not to the other of the Parties, if the former undertakes to pay the share of the latter in a currency acceptable to this latter.

Article 29

1. Income tax payments in accordance with this Agreement and any amounts falling due under Article 30 shall be payable in U. S. Dollars or in sterling or in such other currency as may be acceptable to Banque Mellie, Iran. All other payments due to First Party or the Iranian Government and all payments due by First Party to IPAC, as agent of the joint structure, or Second Party hereunder shall be made in Iranian currency.
2. The principal books and accounts of IPAC, as agent, or Second Party shall be kept in U.S. Dollars and for this purpose conversions from Iranian currency into U.S. Dollars and from U.S. Dollars into Iranian currency shall be made at the weighted average monthly rate of exchange at which Iranian currency was purchased for U.S. Dollars by IPAC or Second Party during the relevant month or, if there was none during the irrelevant month, during the nearest preceding month. At the end of each annual period any exchange differences on the books of IPAC, as agent, or Second Party due to variations in such exchange rate shall be deducted from or added to, as the case may be, the operating costs of IPAC, as agent, or Second Party.
3. The Government shall ensure that IPAC or Second Party shall be able to purchase Iranian currency with U.S. Dollars without discrimination at the bank rate of exchange generally available on the day in question for purchasing Iranian currency with U.S. Dollars. If at any time there is more than one such bank rate, the rate that yields the greatest number of units of Iranian currency shall be applied. The full value of any exchange certificate, fee, premium or similar device shall be reckoned as an integral part of the bank rate.
4. IPAC or Second Party shall not be bound to convert into Iranian currency any part of its funds, except such funds as it considers necessary for meeting the cost of its operations in Iran, which funds shall be converted into Iranian currency through authorized Banks.
5. During the term of this Agreement, and after the termination thereof, IPAC, as agent, or Second Party shall not be restrained from freely retaining or disposing of any funds or assets outside Iran, including such funds or assets as may result from its activities in Iran, or restrained from maintaining foreign exchange accounts in Iran with the Banque Mellie Iran and freely retaining or disposing of, including exporting, any funds standing to the credit thereof to the extent that such funds and assets have been imported by IPAC, as agent, or Second Party into Iran under this Agreement or have been derived from its Operations.
6. Any expenditures incurred or receipts realized in any currency other than U.S. Dollars or Iranian currency shall, in the case of currencies not quoted in Iran, be converted into U.S. Dollars at the arithmetic average of the mean of the daily U.S. Dollar buying and selling rates of exchange as between U.S. Dollars and the currency concerned for the month in question. In the case of currencies quoted in Iran, they shall be converted first into Rials and then into U.S. Dollars, at the average monthly bank commercial rate of exchange, as foreseen in this Article.
7. a) For the purposes of this Agreement and of ascertaining gross receipts earned in Iran for Iranian income tax purposes, Posted Prices quoted in currencies other than U.S. Dollars shall be converted into U.S. Dollars on the basis of the par values for the time being established under the Articles of Agreement of the International Monetary Fund. Failing values so established, First Party and Second Party shall seek agreement as to an acceptable basis for such conversion. In default of such agreement the conversion shall be made on the basis of the mean of the New York buying and selling rates of exchange and between U.S. Dollars and the currency in question as certified by the Banque Mellie Iran as at the close of business on the day in question.
   b) In the case of any day when no New York buying and selling rates are quoted, the rate to be used instead of the mean of the New York buying and selling rates of exchange shall be the mean of the last previous New York quotations for the foreign currency in question as certified by the Banque Mellie Iran. Where the foreign currency in question is not quoted in New York, the rate to be used for the purposes aforesaid, instead of the mean of the New York buying and selling rates of exchange, shall be such rate as the Union de Banques Suisses, Zurich, considers to be appropriate having regard to transactions in that foreign currency.
8. After the termination of this Agreement, the Government shall ensure that funds held by IPAC, as agent, or Second Party in Iranium currency which have been imported into Iran under this Agreement or have been derived from its operations under this Agreement shall be convertible to U.S. Dollars upon demand without discrimination at the bank rate of exchange generally available for purchasing U.S. Dollars.
9. Non-Iranian Directors and employees of IPAC or Second Party and their families shall not be restrained from freely retaining or disposing of any of their funds or assets outside Iran and shall be free to import such foreign funds into Iran as are required for their own needs and not for speculation.

   Such persons shall not be allowed to effect in Iran exchange transactions of any kind through channels other than the Authorized Banks or such other channels as the Government shall approve.
10. Any non-Iranian Director or employee of the IPAC or second party shall, upon the termination of his service in Iran and departure from Iran, be entitled freely to export from Iran, in the currency of the country of his habitual residence, an amount not exceeding 50% of his last 24 months' salary.

Article 30

1. On or before the expiration of thirty days after the Effective Date, Second Party shall pay to First Party, as a cash bonus, the sum of $25,-000,000.00 (twenty-five million U.S. Dollars) by depositing said amount in First Party's account in a bank in New York, New York, the number of said account and the name and address of said bank to be specified by First Party by written notice to Second Party not less than ten days before said payment is to be made.
2. Subject to the provisions of Section 3 below, Second Party shall expend, directly or through IPAC, as agent, a minimum of $82,000,000.00 (eighty-two million U.S. Dollars) in, or in connection with, the Operations undertaken by it under this Agreement during the first twelve annual periods following the Effective Date; such minimum amount to be allocated for expenditure during each of the twelve annual periods in accordance with the following table:

Annual periods next following the Effective Date	Amount
First and each succeeding annual period up to and including the fourth	$8,500,000.00
Fifth annual period and each succeeding annual period up to and including the twelfth	$6,000,000.00

3. Within sixty days after the fourth annual period there shall be determined the total expenditures of Second Party for its Operations during the preceding four annual periods.
   a) If such expenditures are less than the amount allocated for expenditure in such period, the difference shall be added to the amount allocated for expenditure during the suceeding eight annual periods.
   b) If such expenditures exceed the amount allocated for expenditure in such period the excess shall be deducted from the amount allocated for expenditure during the succeeding eight annual periods.
   c) If the carrying out of Second Party's Operations is rendered impossible, hindered or delayed in any year or years due to any force majeure occurrence as provided for in this Agreement, the allocations set forth in the table contained in Section 2 shall not be effected thereby; provided, however, that after such occurrence has ceased to exist Second Party shall fulfill its total obligation under section 2 above before the twelfth anniversary date of the Effective Date or before the expiry of such further period by which the Agreement shall be extended by reason of the force majeure occurrence.
4. During the first four annual periods exploration operations may not be suspended or stopped for any reason whatsoever, except force majeure as provided for in this Agreement. But at the end of the said period and of each of the following eight years, Second Party may, if it considers that the subsurface conditions of the Area preclude a reasonable chance of discovering petroleum in commercial quantities, discontinue exploration operations upon notification of such intention to First

Party and relinquish its rights to the Area after proving that up to the date of such notification, the exploration work planned to be carried out has in fact been so carried out and that all the amounts allocated for expenditure during the period prior to such notification have been fully spent. In the event that there remains an unexpended balance, one half of such balance shall be paid by Second Party to First Party.

5. If upon termination of the twelfth annual period petroleum shall have been discovered but the minimum amount prescribed in Section 2 hereof shall not have been fully spent, Second Party shall pay to First Party one half of the unexpended balance.
6. After discovery of petroleum in commercial quantities within the Area and in not less than sixty days prior to the commencement of any annual period, Second Party may notify First Party of its election to fulfill all or part of its outstanding exploration obligations as set out in Section 2 of this Article, by spending for the Joint Structure account a stated amount on operations other than exploration. Any such expenditure shall be regarded as an expenditure affected in fulfillment of Section 2 of this Article and in such event the obligation of the First Party to contribute to the cost of the operation shall be reduced by one half of such expenditure.
7. If the total expenditure obligation laid down in Section 2 of this Article has been fulfilled but part of the expenditure has been devoted to operations other than exploration, as provided for in Section 6, an additional expenditure on exploration, in the opinion of Second Party becomes necessary, such additional expenditure may be affected by IPAC, as agent of the Joint Structure, to the extent of available income from production already achieved.
8. Second Party shall pay to First Party during the remainder of the term of this Agreement, commencing with the thirteenth year, annual rentals on the thirteenth and each succeeding anniversary date of the Effective Date in the amount as set out in Column A below, wtih respect to the areas retained:

Date of Payment	Column A Total Rental per Square Kilometer
On the thirteenth and each succeeding anniversary date up to and the seventeenth anniversary date	$400
On the eighteenth and each succeeding anniversary date up to and including the twenty-second anniversary date	$480
On the twenty-third and each succeeding anniversary date	$600

The rules concerning inclusion of rental payments in operating costs and the circumstances in which rental shall become a "stated payment" are as set out in Article 9 A of the Petroleum Act.

Article 31

1. First Party and Second Party shall with respect to their respective net incomes from the operations authorized under this Agreement be subject to taxation in accordance with the Iranian income tax Laws as they may prevail from time to time provided that:
   a) The rates of income tax governing the respective Iranian income tax liability of each Party shall not exceed the maximum rate of fifty per cent (50%) provided in the Income Tax Act of 1956 and
   b) Each Party shall with respect to its net income be entitled to provisions not less favorable than those established in Article 35 of the Income Tax Act of 1949 as preserved in Article 36 of the Income Tax Act of 1956.
2. IPAC, acting solely as a non-profit making agent under this agreement shall not be liable to taxation and similarly the Joint Structure relationship of the parties shall not entail any tax obligation.
3. The income tax liability of each Party shall be assessed on the basis of its net income from the operations authorized under this Agreement computed in accordance with accounting practices as generally accepted in the petroleum industry, and the amount of income tax payable by it shall be such liability reduced by any credits against or deductions from such liability to which it shall be entitled under this Agreement, under the Petroleum Act and, subject to the provisions of Section 1 above, under the income tax laws of Iran prevailing from time to time.
4. The gross receipts of each Party in each Taxation Period shall equal the sum of:
   a) The value of its share of the Petroleum supplied by IPAC, as agent of the joint structure, to First Party for Internal Consumption in Iran, computed at the price established in accordance with Article 26 hereof; and payments received for natural gas delivered under Article 27, if any; and
   b) The value of fifty per cent (50%) of all Petroleum otherwise sold, exported or disposed of, excluding any petroleum flared or released to the atmosphere, lost through causes beyond IPAC's control or used in the course of operations, which value shall be computed at the Posted Price published on the date of such sale, export or disposal from which Posted Price there shall be deducted any discounts approved as provided in Article 25 Section 2.
5. Each Party in determining its net income may subtract from its share of gross receipts its share of all costs, expenses and charges incurred by it or by IPAC, as agent, in relation to the operations authorized under this Agreement, as set forth hereunder provided that they are supported by documents or records:
   a) As to Second Party only, during each of the ten taxation periods following the date of commencement of commercial production, an amount equivalent to 10% of the total bonus of $25,000,000.00 paid to First Party under Article 30 of this Agreement;
   b) Those relating to the rental payment as provided for in Article 30, the manner of including rental payment in costs being as prescribed in Article 9A of the Petroleum Act;
   c) Each Party's share of all costs and expenses incurred by IPAC, as agent, necessarily and solely in connection with the carrying on of the operations authorized by this Agreement, including administrative, overhead and established expenses, contributions and rents or other charges for the use of any property, costs of drilling wells not productive of petroleum in commercial quantities, cost of goods and services, expenditures made in connection with ground, aerial or marine surveys or made in connection with drilling cleaning, deepening or completion of wells or the preparation therefor, except in so far as such costs and expenditures have been capitalized and an amortization allowance is subtracted on that account;
   d) A reasonable amount in each year for depreciation, obsolescence, exhaustion and depletion for the amortization of capital expenditure made by IPAC, as agent, in connection with operations in Iran;
   e) The unapplied part of operating losses of each Party sustained in, and carried forward from, previous taxation periods, provided that such carrying forward is not more than ten years from the taxation period during which such losses originated;
   f) Each Party's share of losses sustained in connection with the carrying on of operations in Iran and not compensated for by Insurance or otherwise, including bad debts, losses resulting from claims for damages arising out of operations in Iran, and losses resulting from damage to, or destruction or loss of, stock in trade or any property used in connection with the said operations in Iran.

Article 32

1. Except for the following:
   a) Income tax payments to be made to Iran in accordance with this Agreement;
   b) Customs duties as laid down in Article 33;
   c) Payments to be made to First Party in accordance with this Agreement;
   d) Payments to the Iranian Government of taxes required by the Income Tax Law to be withheld with respect to salaries paid to personnel and payments to contractors or agents for work carried out in Iran;
   e) Reasonable and non-discriminatory charges and fees for services rendered by Governmental authorities on request or to the public generally such as tolls, water rates, sanitary and sewage charges;
   f) Non-discriminatory taxes and fees of general application, such as documentary stamp taxes, civil and commercial registry fees and patent and copyright fees,

Second Party and, where applicable, IPAC shall not be required to make any payment to First Party or to any Iranian Governmental authority, whether central or local, and no taxes shall be imposed on dividends paid by First Party or Second Party from income arising as a result of the Operations authorized by this Agreement.

Article 33

1. All machinery, equipment, craft, apparatus, tools, instruments, spare parts, materials, timber, chemicals, blending materials and additives, automotive equipment and other vehicles, aircraft, building materials, of all descriptions, steelworks, office fillings, equipment and furniture, ship's stores, provisions, protective clothing and equipment, instructional equipment, petroleum products not available in Iran and all other articles required exclusively for the efficient and economical conduct and performance of the operations and functions of Second Party or of IPAC, as agent, shall be imported without any license and exempt from import and other customs duties, charges and other taxes and payments. The foregoing articles shall include medical, surgical and hospital supplies, medical products and drugs and equipment, furniture and instruments required for the installation and operation of hospitals and dispensaries.
2. Second Party and IPAC, as agent, shall with the knowledge of First Party have the right as and when they require to re-export any of the articles imported by them, without any license and exempt from any duties, taxes, or payments.
3. Second Party and IPAC, as agent, shall also have the right, subject to approval by First Party, which approval will not be unreasonably withheld or delayed, to sell in Iran, such articles as they shall have imported it being understood that in any such case it will be the responsibility of the buyer to pay any applicable duties and to comply with any formalities prescribed by the then current regulations, and to furnish Second Party or IPAC, as agent, with the necessary clearance documents.
4. Such articles as may be considered appropriate for the use or consumption of the directors, employees, and their respective dependents of Second Party and IPAC shall be imported without necessity of any license and free of regulation by any government monopoly but upon the payment of any import and customs duties and other taxes generally applicable at the time of importation; but such articles shall not be resold except to the said directors, employees and dependents, exclusively for their use or consumption.
5. Without limiting the generality of their foregoing rights, Second Party or IPAC, as agent, in the acquisition of equipment and supplies shall give preference to articles made or produced in Iran provided the said articles as compared to similar articles of foreign origin, can be acquired on equally advantageous conditions with due regard to their quality, their price, their availability at the time and in the quantities required, and their suitability for the purposes for which they are intended. In comparing the price of imported articles with articles made or produced in Iran account shall be taken of freight and of any customs duty payable under this Agreement on the imported articles.
6. All imports and exports under this Agreement shall be subject to customs documentation and formalities (but not to any payment from which they are exempt under the relevant provisions of this Agreement) not more onerous than those

generally applicable. Such documentation and formalities will be handled simply and expeditiously and to this end necessary arrangements may from time to time be made between the companies concerned and the customs Authorities.

ARTICLE 34

1. The term of this Agreement shall be, in respect of each of the areas on which commercially exploitable fields shall have been discovered, as referred to in Article 3, twenty-five years from the date of commencement of commercial production therein.
2. For the purposes of this Article the date of commencement of commercial production shall be the date on which there shall have been sold and delivered 100,000 cubic meters of petroleum produced from the area concerned.
3. Before the end of the twenty-third year, Second Party may notify First Party of its intention to renew the Agreement, in which case the renewal shall take place automatically and in accordance with the terms of this Agreement for a period of five years from the end of the twenty-fifth year.
4. Two further renewals of five years each shall also be allowed, respectively from the end of the thirtieth and from the end of the thirty-fifth year, notice of the intention to renew to be given by Second Party to First Party in each case two years before the end of the renewal period then running.
5. In respect of the two renewals described in Section 4 the following rule shall be observed. If at the time when Second Party requests the renewal other foreign Oil Companies associated with First Party in view of a similar activity and having already achieved productive results equal or superior to those achieved by IPAC, as agent by the joint structure, shall have concluded agreements containing conditions which are on the whole more favorable to Iran than those contained in this Agreement, all such conditions of the said agreements shall apply to the renewal requested by Second Party.

ARTICLE 35

1. Upon expiry or termination of this Agreement, IPAC shall be liquidated, and the movable properties of the joint structure shall be sold and the proceeds thereof distributed between the Parties in equal shares.
2. All fixed assets as well as lands shall be transferred free of charge to First Party.

ARTICLE 36

1. Second Party may at any time and from time to time transfer all or any part of its interest in the rights acquired and the obligations undertaken by it under this Agreement to:
   a) Any company or companies controlling Second Party;
   b) Any company or companies controlled by Second Party;
   c) Any company or companies controlled by any company or companies specified in (a) or (b) above;

   provided that for the purpose of this Section control of a company shall mean direct or indirect ownership of all of the stock of such company and the transferee is a company satisfying Article 4 of the Petroleum Act. It is recognized that, prior to commencement of operations hereunder, Second Party expects to transfer all its interest in the rights acquired and the obligations undertaken hereunder to its wholly-owned subsidiary, Pan American International Oil Company.
2. Any transfer by Second Party otherwise than as authorized under Section 1 above, shall require the prior written approval of the First Party, which before granting the said approval shall obtain the confirmation of the Council of Ministers and approval of the Legislature which transfer shall not in any way affect Second Party's obligations arising from this assignment.

ARTICLE 37

1. Where any force majeure occurrence beyond the reasonable control of Second Party or IPAC, as agent, renders impossible or hinders or delays the performance of any obligation or the exercise of any right under this Agreement, then:
   a) The failure or omission of Second Party or IPAC, as agent, to perform such obligation shall not be treated as a failure or omission to comply with this Agreement, and
   b) The period whereby such performance or such exercise is delayed shall be added to any relevant periods fixed by this Agreement, and
   c) If the duration of such occurrence is not less than one year, this Agreement shall automatically be extended for a period equal to the duration of such occurrence, without prejudice to any right to further extensions under this Agreement.
2. The term "force majeure" used in this Agreement means occurrences which are recognized as such by the principles of International Law.

ARTICLE 38

1. The Parties undertake to carry out the terms and provisions of this Agreement in accordance with the principles of mutual good will and good faith and to respect the spirit as well as the letter of the said terms and provisions.
2. The confirmation of this Agreement by the Council of Ministers as provided for by Article 2 of the Petroleum Act shall be regarded as acceptance by the Iranian Government of all such obligations as by the terms of this Agreement are laid upon the Government, including any acts to be performed or any consents to be given by it.
3. No general or special legislation or administrative measures or any other act whatsoever of or emanating from the Government or any governmental authority in Iran (whether central or local) or from First Party shall annul this Agreement, amend or modify its provisions or prevent or hinder the due and effective performance of its terms. Such annulment, amendment or modification shall not take place except by the agreement of the Parties.
4. If the functions of First Party are transferred to another entity under the control of or responsible to the Iranian Government, such entity shall assume all the obligations of First Party under this Agreement. If First Party ceases to exist and its functions are not transferred to another entity under the control of or responsible to the Iranian Government, all the obligations of First Party under this Agreement shall be the direct obligations of the Iranian Government.
5. The Ministry of Finance may take any action or give any consent on behalf of the Iranian Government which may be necessary or convenient under or in connection with this Agreement or for its better implementation and any action so taken or consent so given shall be binding upon the Government. All Iranian authorities shall implement all such instructions as the Ministry of Finance shall give them in connection with the execution and administration of this Agreement and such authorities shall have full power and authority to do so. If the Ministry of Finance should for any reason no longer exercise its powers and authority under this Article, such powers and authority shall be exercised by such other Ministry or agency as the Council of Ministers shall designate.

ARTICLE 39

1. If any dispute arises out of the execution or interpretation of this Agreement, the Parties may agree that the matter shall be referred to a mixed Conciliation Committee composed of four members, two nominated by each Party, whose duty shall be to seek a friendly solution. The Conciliation Committee, after having heard the representatives of the Parties, shall give a ruling within three months from the date on which the dispute was referred to it. The ruling, in order to be binding, must be unanimous.
2. If the Parties do not agree upon the reference of a dispute to a Conciliation Committee, or if a dispute is referred to the said Committee but not settled, the sole method of determining it shall be by arbitration in accordance with Article 41.

ARTICLE 40

1. Any dispute relating to technical or accounting questions may by agreement between the Parties be referred either to a single expert or to a body of three experts, of whom two shall be appointed by the Parties (one by each) and the third shall be appointed by mutual consent. If the Parties cannot agree upon the single or the third expert either Party may request the Director of the Eidgenossiche Technische Hochschule of Zurich when the question is a technical one, or the President of the Schweizerische Kammer fur Revisionswesen of Zurich when the question relates to accountancy, to appoint the single expert or the third expert. If within one month from the institution of the proceedings the Parties are not in agreement that the dispute shall be referred to an expert or experts as specified above the arbitration procedure stipulated in Article 41 shall apply.
2. The appointment of an expert or experts by the Parties shall be effected within one month from the institution of the proceedings. The appointment of the third expert shall be made within a further period of one month in case of agreement between the Parties, or of two months in cases where he is appointed after the failure of the Parties to agree. The appointment of a single expert shall be made within three months of the institution of proceedings in cases where he is appointed after the failure of the parties to agree.
3. The technical or accounting questions to be decided shall be clearly and precisely defined by the Parties in the terms of reference. The decision of the single expert or of the three experts shall be given within six months of the appointment of the single expert or the third expert, as the case may be. If the dispute is referred to three experts the decision may be given by a majority. The expert or experts shall give their decision on technical or accounting questions only and the decision so given shall be final and binding on the Parties.
4. If during any proceedings before an expert or experts there arises in the opinion of the expert or experts or of either of the Parties, a question of law (which expression shall include any question as to the interpretation of the Agreement) the determination of which is necessary to a decision upon the technical or accounting question in issue, the question of law shall, if not determined by agreement between the Parties, be submitted to arbitration by the Parties or either of them, either upon their own initiative or at the request of the expert or experts.
5. For the purpose in this connection of determining time limits under this Article, the notification by either Party to the other of its intention to submit a question of law to arbitration as aforesaid, together with a statement of the said question, shall be treated as the institution of proceedings in respect thereof by the Party giving the notice.
6. The proceedings before the expert or experts need not be suspended when a question of law arising in the course thereof is submitted to arbitration unless in the opinion of the expert or experts the question of law is of such a nature that the proceedings cannot usefully be continued until it has been determined. If the proceedings are suspended pending the determination of a question of law, the Parties shall bring the determination, as soon as it has been effected, to the knowledge of the expert or experts in order that he or they shall resume the proceedings and reach a final decision as soon as possible on the Technical or accountancy question which is the subject of the dispute.

ARTICLE 41

1. If the Parties do not agree that a dispute shall be referred to an expert or experts under Article 40 or if they do so agree but the appointments provided for are not made or a decision is not given within the time specified for the purpose, or if in the circumstances set out in Section 4 of Article 40 either of the Parties seeks the determination of a question of law, each of the Parties shall appoint an arbitrator, and the two arbitrators before proceeding to arbitration shall appoint an umpire who shall be the President of the Arbitration Board. If the two arbitrators cannot within four months of the institution of proceedings agree on the person of the umpire,

the latter shall, if the Parties do not otherwise agree, be appointed, at the request of either Party, by the President of the Swiss Federal Tribunal.

2. If one of the Parties does not appoint its arbitrator or does not advise the other Party of the appointment made by it within two months of the institution of proceedings, the other Party shall have the right to apply to the President of the Swiss Federal Tribunal to appoint a sole arbitrator.
3. If for any reason whatsoever the appointment of a sole arbitrator or an umpire is not made in accordance with Section 1 then, unless the Parties shall have otherwise agreed in writing, the said appointment shall be made at the request of either Party by the president or equal judge of the highest court of any of the following nations in the order stated: Denmark, Sweden, Brazil.
4. The appointment of an umpire or sole arbitrator under Section 1 shall be within the complete discretion of the person authorized to make it, and the exercise of his discretion may not be questioned by either Party. The person so appointed should not be closely connected with nor have been in the public service of, nor be a national of, Iran or the United States of America.
5. The umpire or the sole arbitrator (as the case may be) shall notify his acceptance of the nomination within thirty days of receiving notice of his nomination. Failing such notification, it shall be assumed that he has refused the nomination and a new appointment shall be made in accordance with the same procedure.
6. If the arbitration is referred to an Arbitration Board the award may be given by a majority. The parties shall comply in good faith with the award of the Arbitration Board or the Sole Arbitrator (as the case may be).
7. The place and procedure of arbitration shall be determined by the Parties. In case of failure to reach agreement, such place and procedure shall be determined by the expert, the third expert, the umpire or the sole arbitrator (as the case may be).
8. The parties shall extend to the expert or experts or the Arbitration Board or the sole arbitrator all facilities (including access to the petroleum operations) for obtaining any information required for the proper determination of the dispute. The absence or default of any Party to an arbitration shall not be permitted to prevent or hinder the arbitration procedure in any or all of its stages.
9. Pending the issue of a decision or award, the operations or activities which have given rise to the arbitration need not be discontinued. In case the decision or award recognizes that the complaint was justified, provision may be made therein for such reparation as may appropriately be made in favour of the complaint.
10. The costs of an arbitration shall be awarded at the entire discretion of the expert or experts or the Arbitration Board or the sole arbitrator (as the case may be).
11. If for any reason an expert, member of an Arbitration Board or sole arbitrator after having accepted the functions placed upon him is unable or unwilling to enter upon or to complete the determination of a dispute, then, unless the Parties otherwise agree, either Party may request the President of the Swiss Federal Tribunal to decide whether the original appointment is to be treated as at an end. If he so decides, he shall request the person or persons who made the original appointment to appoint a substitute within such time as he shall specify, and if within the time so specified no substitute has been appointed, or if the original appointment was made by him, he shall himself appoint a substitute. If the President of the Swiss Federal Tribunal for any reason whatever does not perform his functions they shall devolve on one of the other persons referred to in Section 3 of this Article in the order therein provided.
12. Wherever appropriate, decisions and awards hereunder shall specify a time for compliance therewith.
13. Either Party may, within fifteen days of the date of the communication of the decision or award to the Parties, request the expert or experts or the Arbitration Board or the sole arbitrator (as the case may be) who gave the original decision or award, to interpret the same. Such a request shall not affect the validity of the decision or award. Any such interpretation shall be given within one month of the date on which it was requested and the execution of the decision or award shall be suspended until the interpretation is given or the expiry of the said month, whichever first occurs.

Article 42

1. If any final decision or award given under Article 41 of this Agreement contains no order other than that a defined sum of money specified in the decision or award shall be paid to the Iranian Government or First Party by Second Party, and if that sum shall not have been paid within the time specified by such decision or award or, if no time is therein specified, within three months thereof, the Iranian Government shall have the right to require the impounding of the proceeds from all sale or export of petroleum from Iran by Second Party until such sum is paid.
2. If the Party liable to execute a final decision or award given in accordance with this Agreement, fails to comply therewith within the time specified for compliance or, if no time is specified, within six months after the communication thereof to the Parties the Party in favour of which the decision or award has been given shall be entitled to seek the termination of this Agreement by a decision of an Arbitration Board or sole Arbitrator made in accordance with Section 3 of this Article. Any such decision shall be without prejudice to any accrued or accruing rights and liabilities arising out of the operation of this Agreement prior to its termination hereunder, including such other rights, sums or damages as may have been awarded by the Arbitration Board or sole arbitrator.
3. The power to make the decision provided for by Section 2 of this Article shall only be exercisable subject to the conditions following, namely:
   a) The decision shall be made only by the Arbitration Board or sole arbitrator who made the final decision or award concerned;
   b) If the Arbitration Board or sole arbitrator who made such decision or award is for any reason unable or unwilling to act, the question of termination for non-compliance with an award shall be referred to arbitration in accordance with this Agreement in the manner provided for determination of disputes.
4. No decision terminating this Agreement shall be made unless the Arbitration Board or sole arbitrator shall first have prescribed a further period (not being less than 90 days) for compliance with the decision or award and after the expiration of such further period shall have found that the decision or award has not then been complied with.

Article 43

1. In respect of the Joint Structure's obligation as laid down in Article 3 to relinquish rights to parts of the Area if Second Party, within the specified time limits, fails so to notify First Party of its view concerning the Areas to be relinquished, then First Party shall at its own discretion determine the parts to be relinquished. Such determination shall be final, and with effect from the date of notice thereof such parts as shall have been determined by First Party shall be regarded as excluded from the Area.
2. Second Party shall deliver to First Party, within ten days after the Effective Date, a letter of guarantee from Standard Oil Company (Indiana) guaranteeing the fulfilment by Second Party of the drilling obligation undertaken under Section 2 of Article 16. In case of failure to carry out said obligation the Standard Oil Company (Indiana) shall forfeit the sum of $350,000 per month for each month of delay not excused by "force Majeure". Upon termination of this agreement the forfeiture obligation shall cease. If within a period of six months from the specified time limit the obligation shall still be outstanding, First Party shall be entitled to terminate this Agreement.
3. The provisions of Article 37 relating to force majeure shall apply to the cases envisaged by this Article.

Article 44

The Persian and English texts of this Agreement are both valid. In case of dispute which is referred to arbitration, both texts shall be laid before the Arbitration Board or the sole Arbitrator (as the case may be) who shall interpret the intention of the parties from both texts. If there is any divergence between the texts as to the rights and duties hereunder of the parties, the English text shall prevail.

Article 45

The provisions of the Mining Act of 1957 shall not be applicable to this Agreement, and any other laws and regulations which may be wholly or partly inconsistent with the provisions of this Agreement shall to the extent of any such inconsistency be of no effect in respect of the provisions of this Agreement.

Executed and delivered at Tehran on this the ..... day of Ordibehesht, 1937, corresponding to the ..... day of April, 1958.

National Iranian Oil Company

By .....
President

Pan American Petroleum Corporation

By .....
Its Attorney-in-fact

Schedule 1

Boundaries of the Area of Operation

AREA I:

From point (a) situated in the sea at approximate longitude 48° 54′ 00″, latitude 29° 38′ 00″ (coinciding with point (b) of SIRIP's area, referred to in Pre-Announcement No. 228/1) thence on a line in a northerly direction, coinciding with the median line of the Gulf to:

Point (b) where the meridian of longitude 48° 54′ 00″ intersects the three mile line of territorial waters from the lowest tide line of the mainland, at approximate latitude 29° 53′ 30″ thence on a line coincidental with the three mile territorial water line described above to:

Point (c) where the same three mile territorial waterline intersects the meridian of longitude 49° 33′ 30″ at approximate latitude of 29° 57′ 30″ (coinciding with point (c) of SIRIP's area referred to in Pre-Announcement No. 228/1), thence on a straight line back to point (a), mentioned above.

The above described Area I contains approximately 1,000 square kilometers.

AREA II:

From point (a) (coinciding with point (e) of SIRIP's area referred to in Pre-Announcement No. 228/1) situated in the sea at approximate longitude 49° 4′ 00″, latitude 29° 15′ 00″, thence on a straight line to:

Point (b) where the meridian of longitude 50° 13′ 00″ intersects the three mile line of territorial waters from the lowest tide line of the mainland, at approximate latitude of 29° 49′ 30″ (coinciding with point (d) of SIRIP's area, referred to in Pre-Announcement No. 228/1) thence on a line coincidental with the three mile territorial water line described above to:

Point (c) where the same three mile territorial water line intersects the meridian of longitude 50° 45′ 00″ at approximate latitude of 28° 59′ 00″, thence on a straight line to:

Point (d) at longitude of 49° 45′ 00″, a latitude of 28° 23′ 00″, thence on a straight line (coinciding with the median line of the Gulf) back to point (a) mentioned above.

The above described Area II contains approximately 15,000 square kilometers, excluding the islands of Kharg and Khargo and the three mile territorial waters of each, which this described area surrounds.

END

The J. B. Beaird Company, Inc. *Glenn Mason, Cunningham & Associates*	13
Birkett, Billington & Newton Ltd. *S. C. Peacock Ltd.*	85
Born Engineering Company *Watts, Payne—Advertising, Inc.*	58
The British Petroleum Company Limited *S. H. Benson Ltd.*	67
The British Petroleum Company Limited *Doremus & Company*	56-57
The Butterley Company Limited *Rowlinson Broughton*	1
California Texas Oil Co., Ltd. *Gaynor & Ducas*	9
Cameron Iron Works, Inc. *Boone & Cummings*	Cover II
Chicago Bridge & Iron Company *Russell T. Gray, Inc.*	19
Cities Service Oil Co. *Ellington & Co., Inc.*	61
Societe J. Cocard, Lille *Perfex Publicitie*	82
Cochran & Co. (Annan) Ltd. *The Technical Advertising Service Ltd.*	77
M. J. Crose Mfg. Co., Inc. *Paul Locke Advertising, Inc.*	76
Davey, Paxman & Co., Ltd. *Joughin Advertising Ltd.*	81
Dresser Industries, Inc.	Cover III
E. L. duPont de Nemours & Co. (Inc.) *The Rumrill Company Inc.*	17-18
Emco Brass Manufacturing Co. Ltd. *KS Advertising Ltd.*	90
Engelhard Industries, Inc. *Stuart Sande, Advertising*	20
Evershed & Vignoles Ltd. *E. Walter George Ltd.*	34
Fish Engineering Corporation *Rives, Dyke & Company*	71
The General Electric Co. Ltd. of England *Kingscott Ltd.*	22
Geolograph Company *Lowe Runkle Company*	100
Grill Floors Ltd. *J. Peers & Associates Ltd.*	4
Halliburton Oil Well Cementing Company *Herbert E. Hill Advertising, Inc.*	33
Imperial Chemical Industries Limited *Clifford Martin Ltd.*	32
International Standard Electric Corporation *J. M. Mathes, Incorporated*	11
Johnston Testers, Inc. *Rives, Dyke & Company*	21
Kalle & Co. Aktiengesellschaft *Anzeigen-Koetter GMBH*	54
M. W. Kellogg Company *Fuller & Smith & Ross Inc.*	7
Ketjen N. V. *Raedt en Bate*	16
Lake & Elliot Ltd. *Ripley, Preston & Co. Ltd.*	89
Le Grand Sutcliff & Gell Ltd. *KS Advertising Ltd.*	73
The Lummus Company *G. M. Basford Company*	2-3
Manning, Maxwell & Moore, Inc. *Fuller & Smith & Ross Inc.*	64-65
McCullough Tool Company *Raymond O. Perry, Advertising*	33
Metropolitan-Vickers Electrical Co. Ltd. *Technical & General Advertising Agency Ltd.*	31
Mid-Continent Supply Company *Magnussen Advertising Agency*	25
Newman, Hender & Company Ltd. *Adams Bros. & Shardlow Ltd.*	10
James North Export Ltd. *John Haddon & Company Ltd.*	91
Oil Center Tool *Rives, Dyke & Company*	Cover IV
Procon Incorporated *Sam J. Gallay/Advertising*	62
The Pyrene Company Limited *Nelson Advertising Service Ltd.*	28
Rolls Royce Limited *Dorland Advertising Ltd.*	84
Schlumberger Surenco *Rives, Dyke & Company*	53
Shell Oil Company *Kenyon & Eckhardt Inc.*	23
Siebe Gorman & Company Ltd. *Technical & General Advertising Agency Ltd.*	86
Sinex Engineering Company Ltd. *Townend Smith & Hardy Ltd.*	85
Peter Spence & Sons Ltd. *Holmwood Advertising Ltd.*	69
Standard Oil Company (New Jersey) *McCann-Erickson, Incorporated*	75
Stewart & Stevenson Services, Inc. *Rives, Dyke & Company*	6
Stone & Webster Engineering Corporation *Harold Cabot & Co. Inc.*	101
Sun Shipbuilding & Dry Dock Company *Doremus-Eshleman Company*	15
Sunvic Controls Ltd. *Crane Publicity Ltd.*	102
Temperature Limited *J. Peers & Associates Ltd.*	24
Universal Oil Products Company *Sam J. Gallay/Advertising*	26-27
Universal Oil Products Company, Products Dept. *Sam J. Gallay/Advertising*	35
Vokes Ltd. *Crane Publicity Ltd.*	87
Westinghouse Electric International Company *Reach, McClinton & Company, Inc.*	29
Williams Brothers *Benton Ferguson & Associates*	80
Wood Brothers & Company (Gaskets) Ltd.	78
Woodfield Hoist & Associated Industries Ltd. *KS Advertising Ltd.*	79

ADVERTISERS' INDEX

(Advertising Agencies in Italics)

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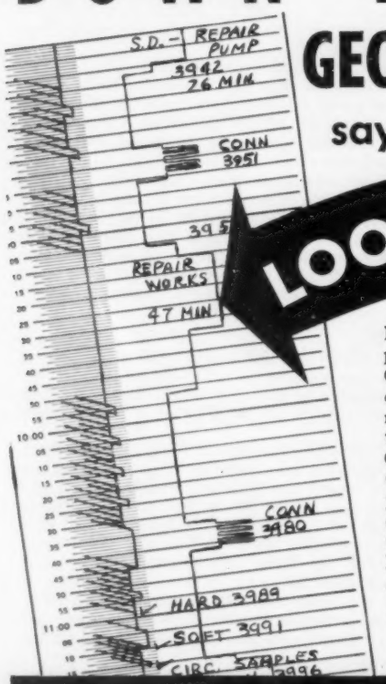

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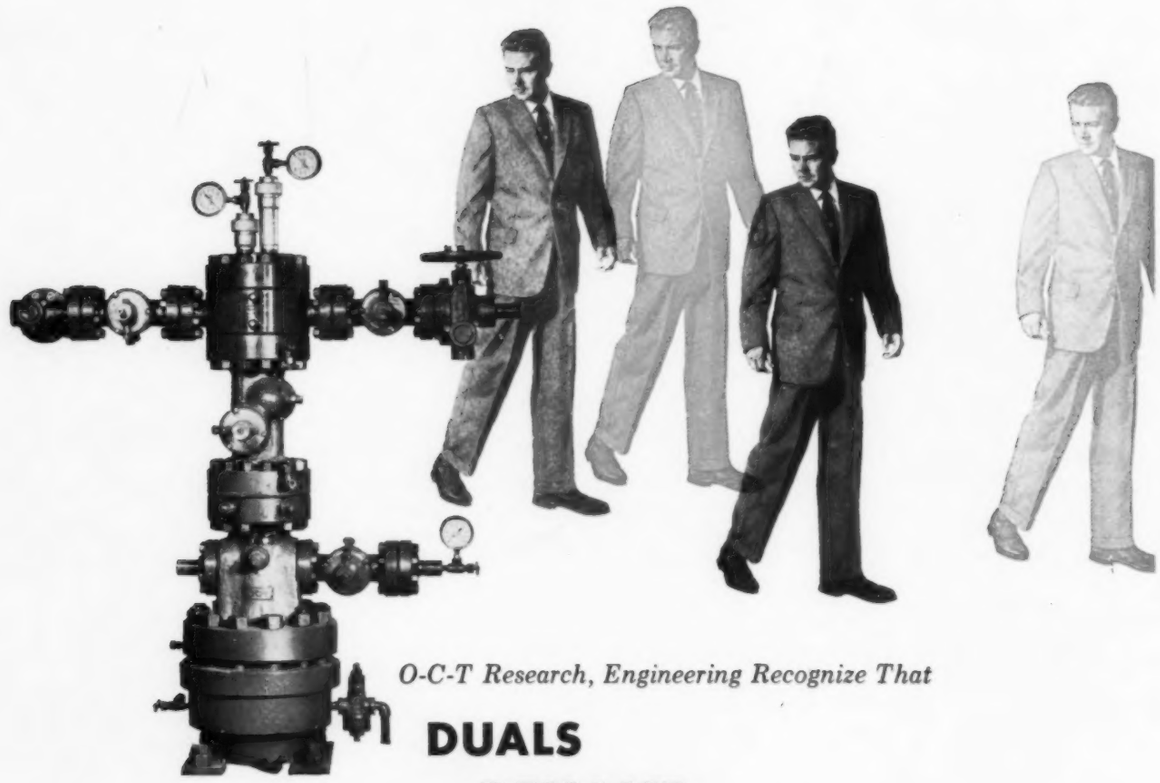

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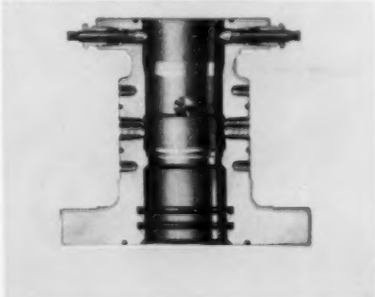
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